

FCC TYPE APPROVAL SUBMISSION

EQUIPMENT: MARINE RADAR

NKE-2044

CERTIFICATION

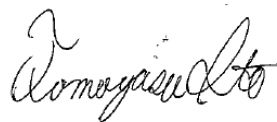
TO: FEDERAL COMMUNICATIONS COMMISSION
SUBJECT: TEST DATA FOR TYPE ACCEPTANCE OF NKE-2044
FCC ID: CKENKE2044
SUPPLIER: JAPAN RADIO CO., LTD/SEATTLE OFFICE
1021 SW Klickitat Way, Bldg D, Suite 101 Seattle, WA98134, U.S.A
PHONE: 206-654-5644
MANUFACTURER: JAPAN RADIO CO., LTD.
1-1 SHIMORENJAKU 5 CHOME,
MITAKA-SHI,
TOKYO, JAPAN

This equipment has been tested in accordance with the requirements contained in the appropriate commission regulation. To the best of my knowledge, these tests were performed using measurement procedures consistent with industry or commission standards and demonstrate that the equipment complies with the appropriate standards. Each unit manufactured, imported or marketed, as defined in the commission's regulations, will conform to the sample(s) tested within the variations that can be expected due to quantity production and testing on a statistical basis. I further certify that the necessary measurements were made by JAPAN RADIO CO., Ltd, 1-1 SHIMORENJAKU, 5 CHOME, MITAKA-SHI, TOKYO, JAPAN.

○Brief history

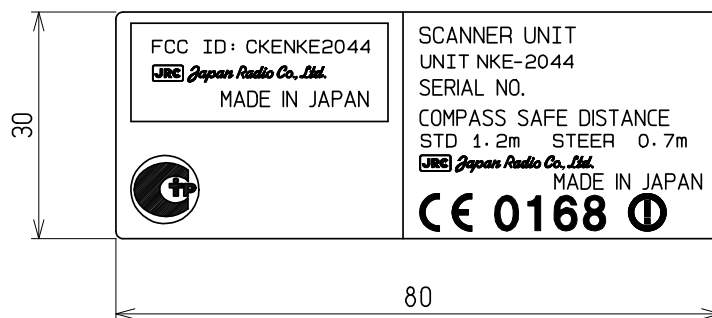
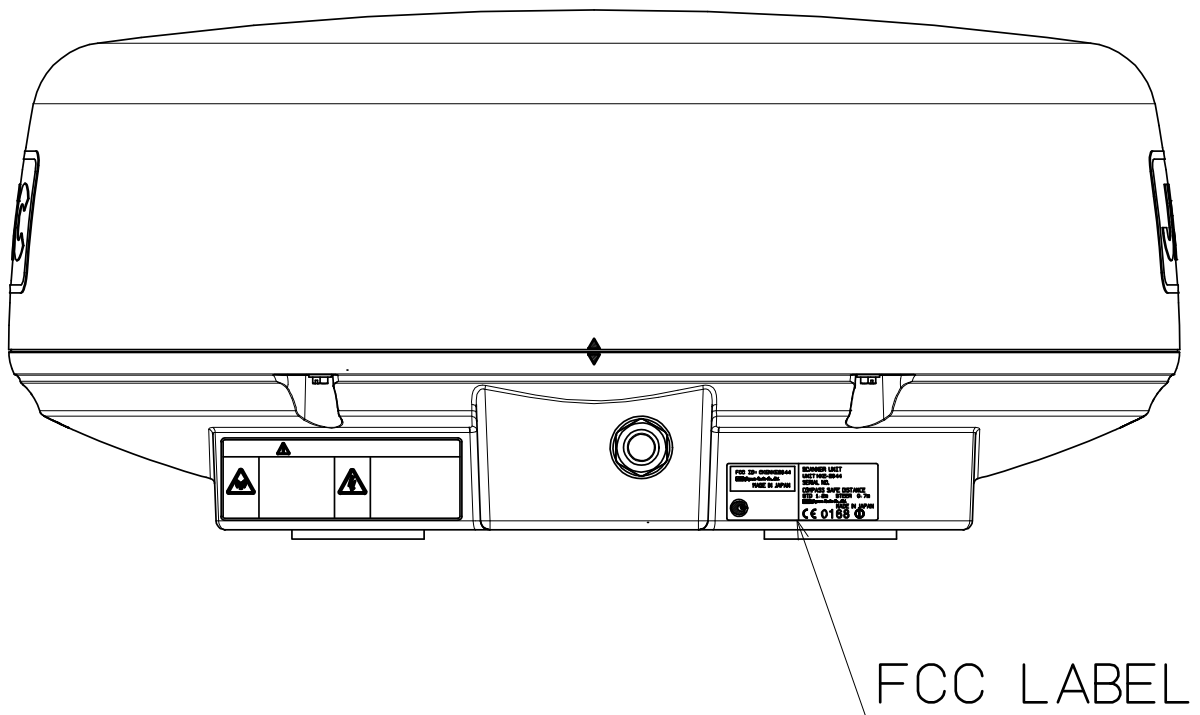
- 1997: I graduated from Electronic information Engineering Section of Engineering Department at Tamagawa University graduate school.
- 2013: I have been engaging in the research and the development various type of marine radar equipments as well as assisting in their production in Japan Radio Co., Ltd.

JAPAN RADIO CO., LTD.



T.Ito

NKE-2044 SCANNER UNIT



1. SYSTEM DESCRIPTION

★NKE-2044

Type of Unit: Scanner unit

The MTR is installed within a 2 feet scanner unit.

The scanner weight is approximately 10.5 kg.

The antenna is rotated 16, 20, 24, 27, 30, 36, 42 and 48rpm by its driving motor.

This has a 4 degrees horizontal beam width and 25 degrees for vertical.

The transmitter operates with 7-pulse length and 6-pulse repetition frequencies.

The magnetron, MSF1421B, rated output is 4kw and is driven by solid-state modulator.

The receiver has a microwave front end, containing the low noise amplifier, mixer, local oscillator, IF amplifier and detector.

GENERAL SPECIFICATION

1. Dimensions:	Height: 275mm, Diameter of radome: 620mm
2. Mass:	Approx. 10.5kg
3. Polarization:	Horizontal
4. Beam width	
Horizontal (-3dB):	4 degree
Vertical (-3dB):	25 degree
Side lobe level:	Less than -21dB within 10 degree of main beam
5. Rotation speed:	16, 20, 24, 27, 30, 36, 42 and 48rpm
6. Frequency:	9410±30MHz
7. Peak Power:	4kW
8. Pulse length / Repetition frequency:	0.08us/4000Hz, 0.08us/2250Hz, 0.13us/1700Hz 0.25us/1700Hz, 0.5us/1200Hz, 0.8us/750Hz, 1.0us/650Hz
9. Modulator:	Solid-state modulator
10. Duplexer:	Circulator / Diode Limiter
11. Front end module:	Built in
12. IF amplifier:	Logarithmic amplifier, Noise figure 6dB maximum.
13. Tuning:	Manual / Auto



Japan Radio Co., Ltd.

Mitaka Plant, 1-1 Shimorenjaku, 5-Chome, Mitaka-shi

Tokyo 181-8510 Japan

Fax: +81(0)422 45 9819

Tel: +81(0)422 45 9923

Declaration of conformity to FCC Part 80 for Marine Radar

FCC ID: CKENKE2044

We: Japan Radio Company Limited

declare under our sole responsibility that the CKENKE2044 scanner unit
conforms to the CFR part 80 rules for Marine Radars

Signed:

Date: 12th December, 2013

Mr. Y. Kinoshita
Manager of Digital-Core Group
Product Design Department
Technology

Signed:

T. Ito
Deputy Manager of Analog-core Group
Product Design Department
Technology

3. TEST RESULTS SUMMARY

3.1 Mechanical Tests

Appearance and Structure

Scanner Unit	Good
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3.2 Electrical Tests

3.2.1 Working of each operation unit

Scanner Unit	Good
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3.2.2 Scanner

VSWR	frequency (MHz)	VSWR
	9380	1.02
	9410	1.03
	9440	1.04
Scanner Rotation Speed	16, 20, 24, 27, 30, 36, 42 and 48rpm	

3.2.3 Transmitter

Magnetron Ser. No.	SJ1B/T2450C
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Operating Frequency

(at 0.08us / 4000Hz pulse, SP1)	9418.0MHz
(at 0.08us / 2250Hz pulse, SP2)	9416.7 MHz
(at 0.13us / 1700Hz pulse, SP3)	9415.7 MHz
(at 0.25us / 1700Hz pulse, MP1)	9415.0 MHz
(at 0.50us / 1200Hz pulse, MP2)	9414.7 MHz
(at 0.80us / 750Hz pulse, LP1)	9414.0 MHz
(at 1.00us / 650Hz pulse, LP2)	9414.0 MHz

RF power output

	Peak power	Average power
(at 0.08us / 4000Hz pulse, SP1)	3.45kW	1.19W
(at 0.08us / 2250Hz pulse, SP2)	3.50kW	0.68W
(at 0.13us / 1700Hz pulse, SP3)	3.49kW	0.87W
(at 0.25us / 1700Hz pulse, MP1)	3.40kW	1.39W
(at 0.50us / 1200Hz pulse, MP2)	3.40kW	2.02W
(at 0.80us / 750Hz pulse, LP1)	3.41kW	2.04W
(at 1.00us / 650Hz pulse, LP2)	3.39kW	2.21W

Pulse Length

(at 0.08us / 4000Hz pulse, SP1)	0.086us
(at 0.08us / 2250Hz pulse, SP2)	0.086us
(at 0.13us / 1700Hz pulse, SP3)	0.146us
(at 0.25us / 1700Hz pulse, MP1)	0.240us
(at 0.50us / 1200Hz pulse, MP2)	0.494us

(at 0.80us / 750Hz pulse, LP1)	0.796us
(at 1.00us / 650Hz pulse, LP2)	0.996us

Repetition Frequency

(at 0.08us / 4000Hz pulse, SP1)	4017Hz
(at 0.08us / 2250Hz pulse, SP2)	2251Hz
(at 0.13us / 1700Hz pulse, SP3)	1704Hz
(at 0.25us / 1700Hz pulse, MP1)	1704Hz
(at 0.50us / 1200Hz pulse, MP2)	1205Hz
(at 0.80us / 750Hz pulse, LP1)	752.3Hz
(at 1.00us / 650Hz pulse, LP2)	653.6Hz

Spurious Emission at Antenna Terminal	Good
Field strength of spurious radiation	Good
Radiofrequency radiation exposure limits	Good

3.2.4 Receiver

MIC Front-end Ser. No.	B4191A
Diode limiter Ser. No.	B7675B
IF Center Frequency	60 MHz
IF Bandwidth	20/6/3 MHz

3.2.5 Dissipation Current (Power)

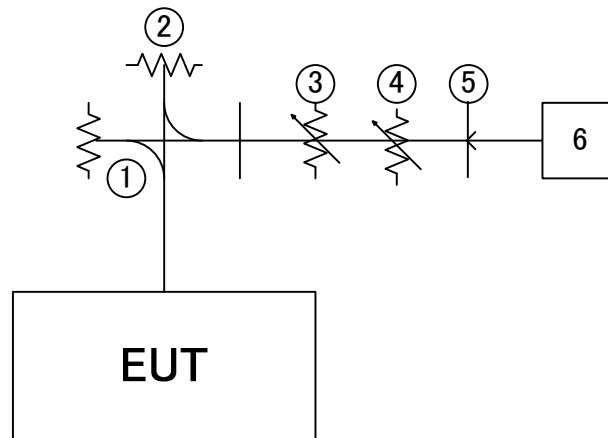
Input Voltage	12V
(at 0.08us / 4000Hz pulse, SP1)	2.31A(27.72W)
(at 0.08us / 2250Hz pulse, SP2)	2.03A(24.36W)
(at 0.13us / 1700Hz pulse, SP3)	2.03A(24.36W)
(at 0.25us / 1700Hz pulse, MP1)	2.23A(26.76W)
(at 0.50us / 1200Hz pulse, MP2)	2.37A(28.44W)
(at 0.80us / 750Hz pulse, LP1)	2.30A(27.6W)
(at 1.0us / 650Hz pulse, LP2)	2.32A(27.84W)

3.3 Overall Tests

Working Time of Timer	1min30sec
Input Variation (10.8VDC – 31.2VDC)	Good
Overall Sensitivity	Good
Minimum Range	Good
Bearing Accuracy	Good
Mechanical Noise	Good

4.1 RF Power Output

4.1.1 TEST SETUP



4.1.2 TEST INSTRUMENTS

	DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATION DATE	CALIBRATION DUE DATE
1	Direction Coupler (30dB) ATM	90-302A-30-6-6	H328005-01	NA	NA
2	High Power Dummy Load PASTERNAK	PE6824	NA	NA	NA
3	Variable Attenuator Agilent	8495B	2814A12827	Sep. 26. 2013	Sep. 2014
4	Variable Attenuator Agilent	8494B	2812A14938	Sep. 25. 2013	Sep. 2014
5	Power Sensor Agilent	N1921A	MY45241558	Oct. 24. 2013	Oct. 2014
6	Peak Power meter Agilent	N1911A	MY45101199	Oct. 11. 2013	Oct. 2014

4.1.3 TEST PROCEDURES

- Setup EUT as 4.1.1.
- EUT can be transmitted six pulses are 0.08us/4000Hz, 0.08us/2250Hz, 0.13us/1700Hz 0.25us/1700Hz, 0.5us/1200Hz, 0.8us/750Hz and 1.0us/650Hz.
- The RF power output was measured at the antenna feed point using a peak power meter.

4.1.4 TEST RESULTS

PW [usec] / PRF [Hz]	Output Power[kW]
0.08 / 4000	3.45
0.08 / 2250	3.50
0.13 / 1700	3.49
0.25 / 1700	3.40
0.5 / 1200	3.40
0.8 / 750	3.41
1.0 / 650	3.39

4.1.5 TEST CONDITIONS

$T_{amb} = 20^{\circ}\text{C}$ to 25°C , $RH_{amb} = 40\% \sim 60\%$

EUT input = 12 VDC

4.1.6 STABILIZATION

EUT energized for 10 minutes minimum.

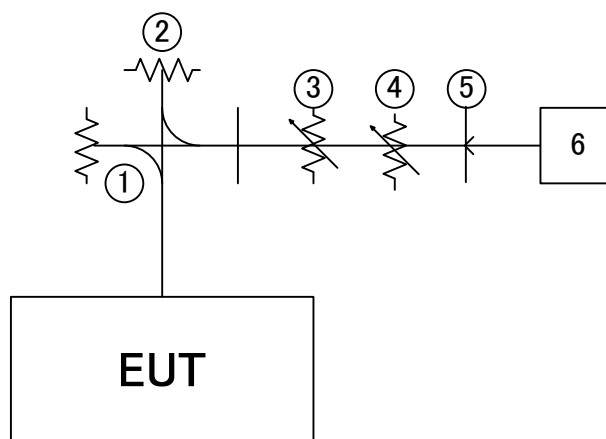
4.1.7 DATE

26th Nov., 2013

TESTED BY T. Ito

4.2 Modulation characteristics

4.2.1 TEST SETUP



4.2.2 TEST INSTRUMENTS

	DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATION DATE	CALIBRATION DUE DATE
1	Direction Coupler (30dB) ATM	90-302A-30-6-6	H328005-01	NA	NA
2	High Power Dummy Load PASTERNAK	PE6824	NA	NA	NA
3	Variable Attenuator Agilent	8495B	2814A12827	Sep. 26. 2013	Sep. 2014
4	Variable Attenuator Agilent	8494B	2812A14938	Sep. 25. 2013	Sep. 2014
5	Detector HP	423B	NA	NA	NA
6	Oscilloscope Tektronix	DPO4034B	C010588	Dec. 17. 2012	Dec. 2013

4.2.3 TEST PROCEDURES

a. Setup EUT as 4.2.1.

b. EUT can be transmitted six pulses are 0.08us/4000Hz, 0.08us/2250Hz, 0.13us/1700Hz 0.25us/1700Hz, 0.5us/1200Hz, 0.8us/750Hz and 1.0us/650Hz.

4.2.4 TEST RESULTS

PW [usec] / PRF [Hz]	Pulse widths[us]	Pulse rep. rate[Hz]
0.08 / 4000	0.086	4017
0.08 / 2250	0.086	2251
0.13 / 1700	0.146	1704
0.25 / 1700	0.240	1704
0.5 / 1200	0.494	1205
0.8 / 750	0.796	752.3
1.0 / 650	0.996	653.6

4.2.5 TEST CONDITIONS

$T_{\text{amb}} = 20^{\circ}\text{C}$ to 25°C , $\text{RH}_{\text{amb}} = 40\% \sim 60\%$

EUT input = 12 VDC

4.2.6 STABILIZATION

EUT energized for 10 minutes minimum.

4.2.7 DATE

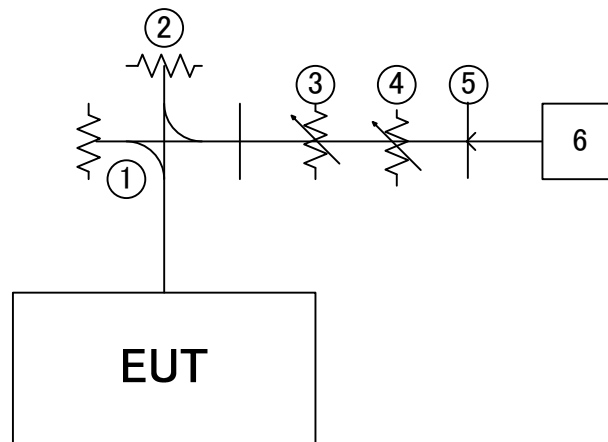
26th Nov., 2013

TESTED BY T. Ito

4.3 Spurious emission at antenna terminals

47 CFR sec. 2.1051

4.3.1 TEST SETUP



4.3.2 TEST INSTRUMENT

	DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATION DATE	CALIBRATION DUE DATE
1	Direction Coupler (30dB) ATM	90-302A-30-6-6	H328005-01	NA	NA
2	High Power Dummy Load PASTERNAK	PE6824	NA	NA	NA
3	Variable Attenuator Agilent	8495B	2814A12827	Sep. 26. 2013	Sep. 2014
4	Variable Attenuator Agilent	8494B	2812A14938	Sep. 25. 2013	Sep. 2014
5	Coaxial Cable Gore	0G0S10S1059	NA	NA	NA
6	Spectrum Analyzer Agilent	E4448A	MY50180037	Nov. 2013	Nov. 2014

Measurement Point : Antenna terminal

Spectrum Analyzer setting: RBW = 10kHz less than 1GHz, 1MHz above 1GHz

VBW = 300kHz less than 1GHz, 3MHz above 1GHz

Detector Mode = Positive Peak

4.3.3 TEST PROCEDURES

- Setup EUT as 4.3.1.
- Transmitted and adjusted attenuator for not exceeding the spectrum analyzer maximum rating at each pulse.
- The average power was calculated based on the standard formula for radar systems.

Average power= Pulse width * Pulse rep rate *Peak power

In case of NKE-2044, Average power for each pulses are following.

PW [usec] / PRF [Hz]	Average Power[W]
0.08 / 4000	1.19
0.08 / 2250	0.68
0.13 / 1700	0.87
0.25 / 1700	1.39
0.5 / 1200	2.02
0.8 / 750	2.04
1.0 / 650	2.21

d. Transmitted at most powerful pulse on average power is 1.0us/650Hz.

4.3.4 TEST RESULTS

No spurious emissions observed above minimum standard.

Test data is described at section 4.3.8

4.3.5 TEST CONDITIONS

$T_{amb} = 20^{\circ}\text{C}$ to 25°C , $RH_{amb} = 40\% \sim 60\%$

EUT input = 12VDC

4.3.6 STABILIZATION

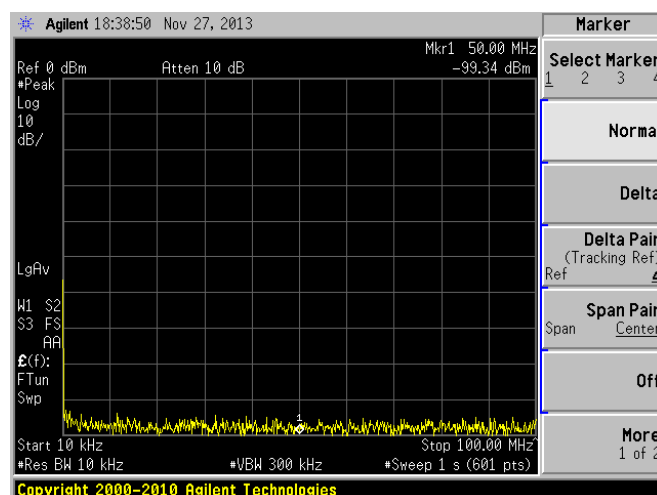
EUT energized for 10 minutes minimum.

4.3.7 DATE

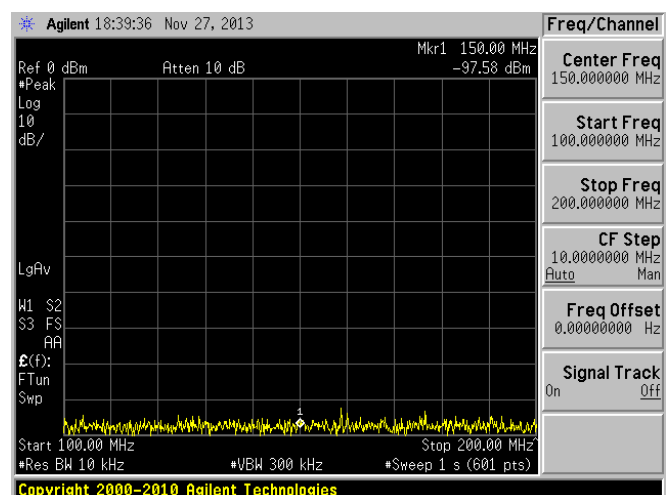
27th Nov., 2013

TESTED BY T. Ito

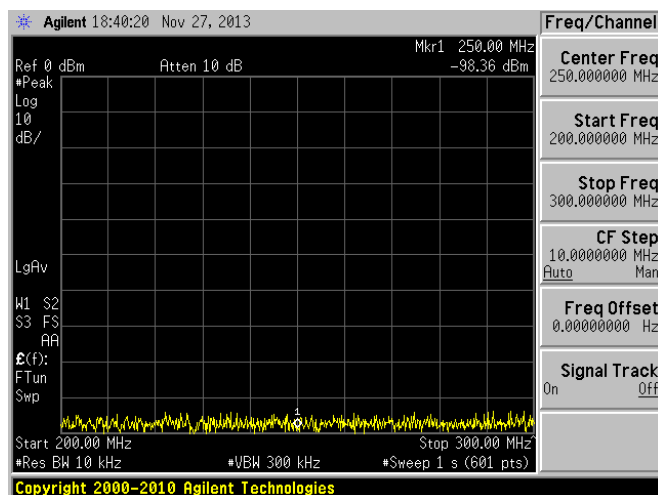
4.3.8 TEST RESULTS of 1.0usec/650Hz pulse



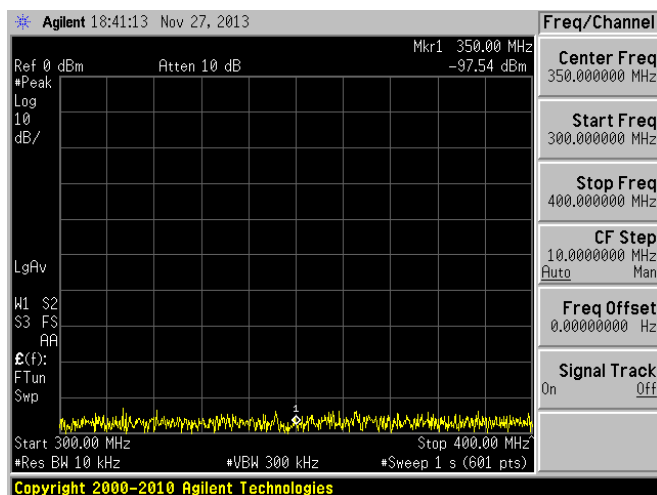
10kHz to 100MHz



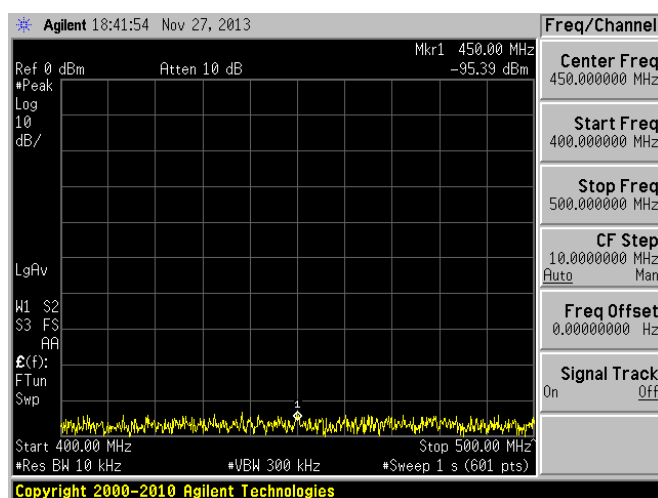
100MHz to 200MHz



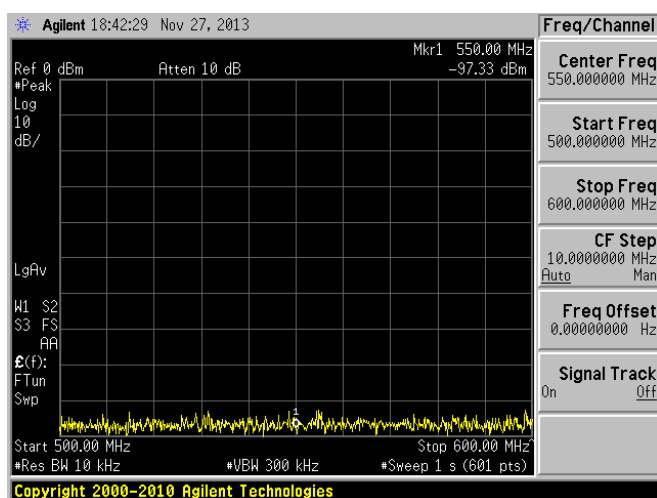
200MHz to 300MHz



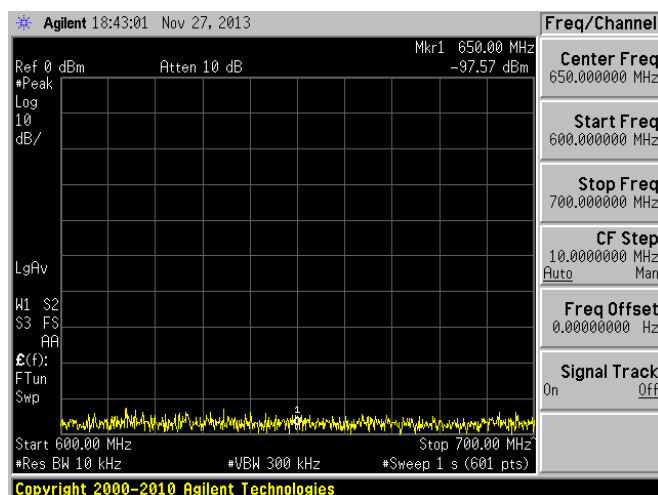
300MHz to 400MHz



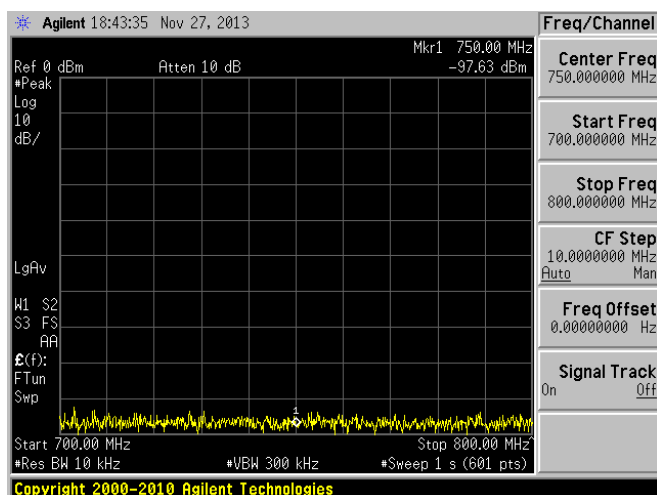
400MHz to 500MHz



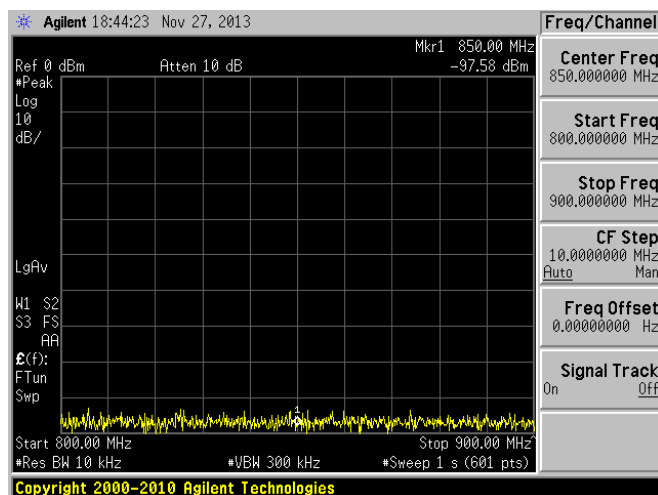
500MHz to 600MHz



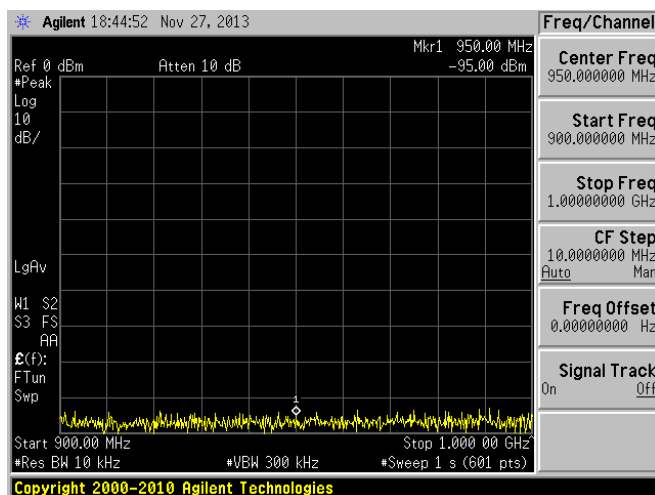
600MHz to 700MHz



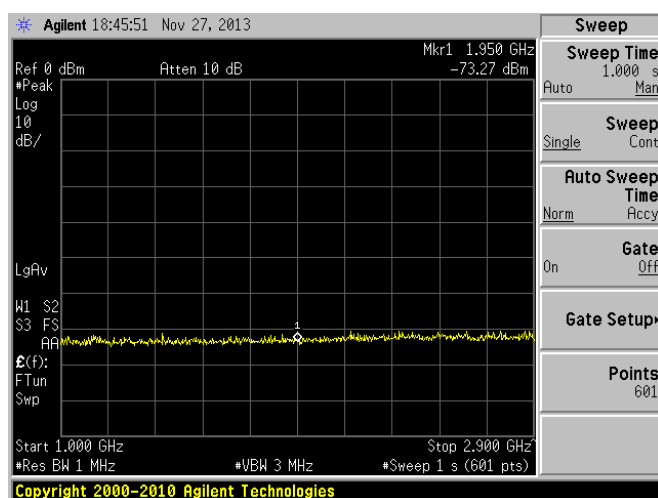
700MHz to 800MHz



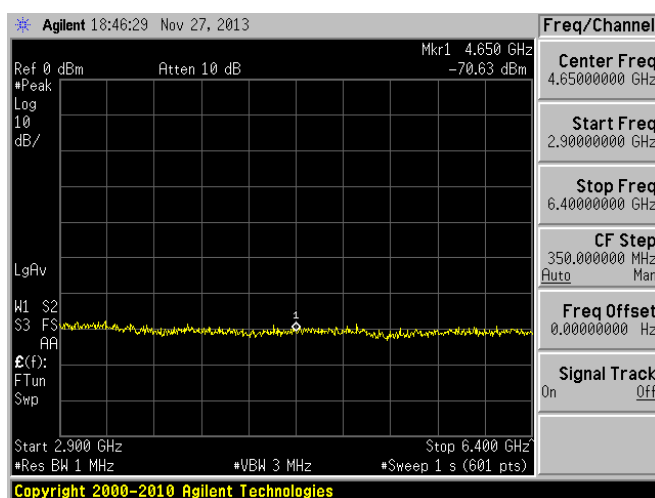
800MHz to 900MHz



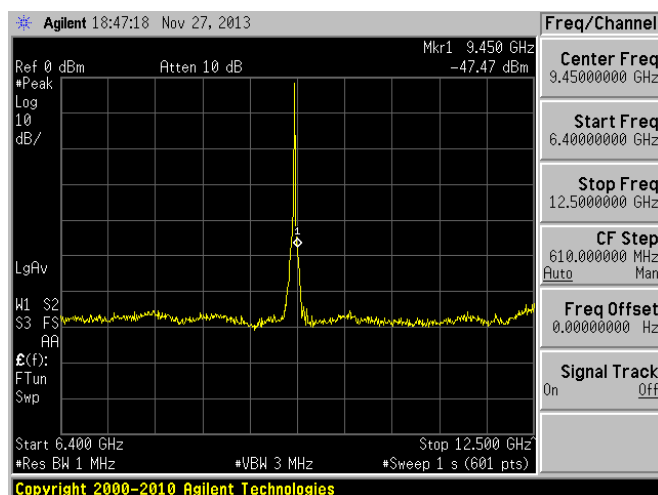
900MHz to 1GHz



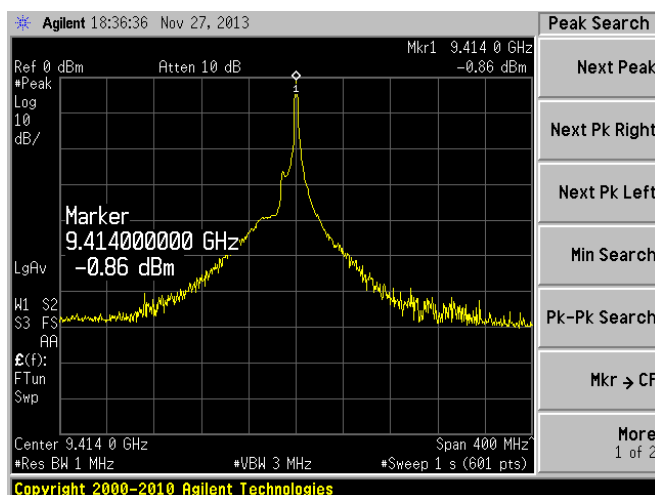
1.0GHz to 2.9GHz



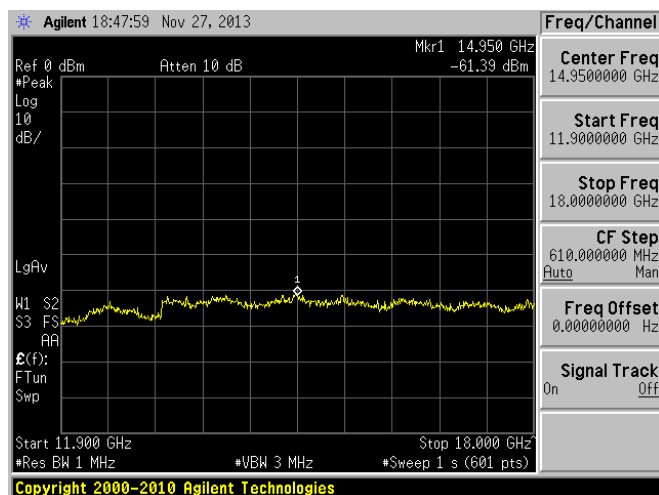
2.9GHz to 6.4GHz



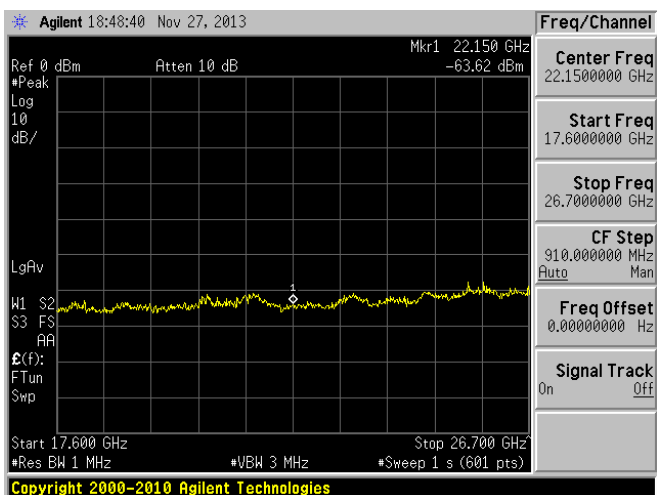
6.4GHz to 12.5GHz



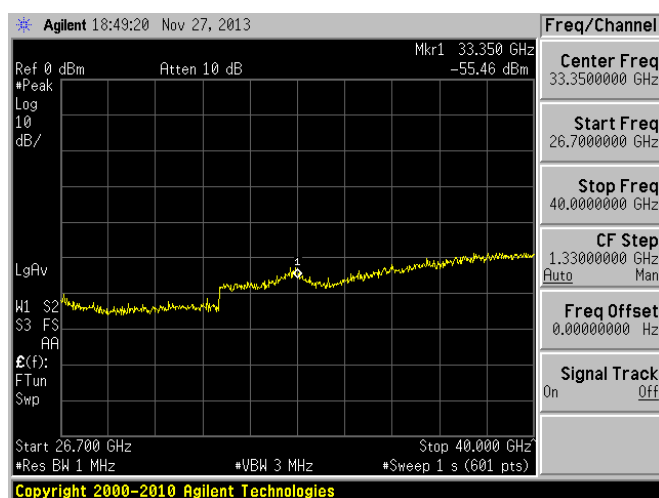
Center 9414MHz, Span 400MHz



11.9GHz to 18GHz



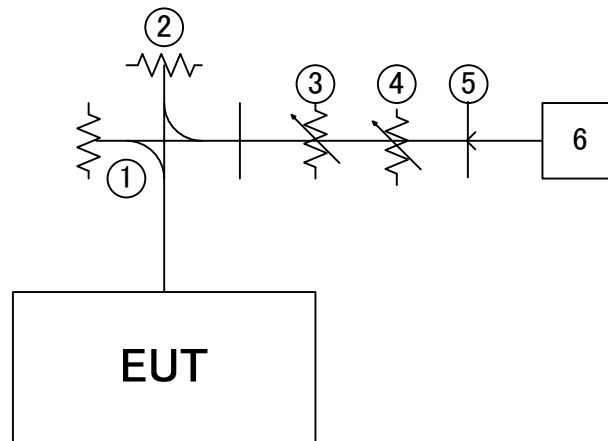
17.6GHz to 26.7GHz



26.7GHz to 40GHz

4.4 Occupied bandwidth plots

4.4.1 TEST SETUP



4.4.2 TEST INSTRUMENT

	DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATION DATE	CALIBRATION DUE DATE
1	Direction Coupler (30dB) ATM	90-302A-30-6-6	H328005-01	NA	NA
2	High Power Dummy Load PASTERNAK	PE6824	NA	NA	NA
3	Variable Attenuator Agilent	8495B	2814A12827	Sep. 26. 2013	Sep. 2014
4	Variable Attenuator Agilent	8494B	2812A14938	Sep. 25. 2013	Sep. 2014
5	Coaxial Cable Gore	0G0S10S1059	NA	NA	NA
6	Spectrum Analyzer Agilent	E4448A	MY50180037	Nov. 2013	Nov. 2014

Measurement Point : Antenna terminal

Spectrum Analyzer setting: RBW = 1MHz above 1GHz

VBW = 1MHz above 1GHz

Detector Mode = Positive Peak

4.4.3 TEST PROCEDURES

- Setup EUT as 4.4.1.
- Transmitted and adjusted attenuator for not exceeding the spectrum analyzer maximum rating at each pulse.
- EUT can be transmitted six pulses are 0.08us/4000Hz, 0.08us/2250Hz, 0.13us/1700Hz 0.25us/1700Hz, 0.5us/1200Hz, 0.8us/750Hz and 1.0us/650Hz.

4.4.4 TEST RESULTS

Test data is described at section 4.4.8

4.4.5 TEST CONDITIONS

$T_{amb} = 20^{\circ}\text{C}$ to 25°C , $RH_{amb} = 40\% \sim 60\%$

EUT input = 12 VDC

4.4.6 STABILIZATION

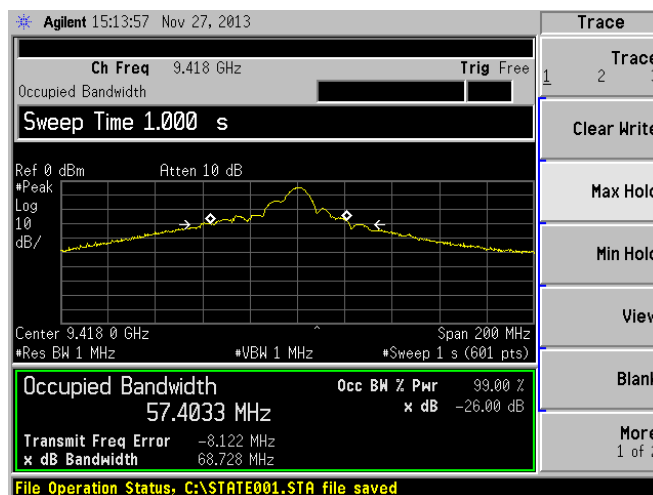
EUT energized for 10 minutes minimum.

4.4.7 DATE

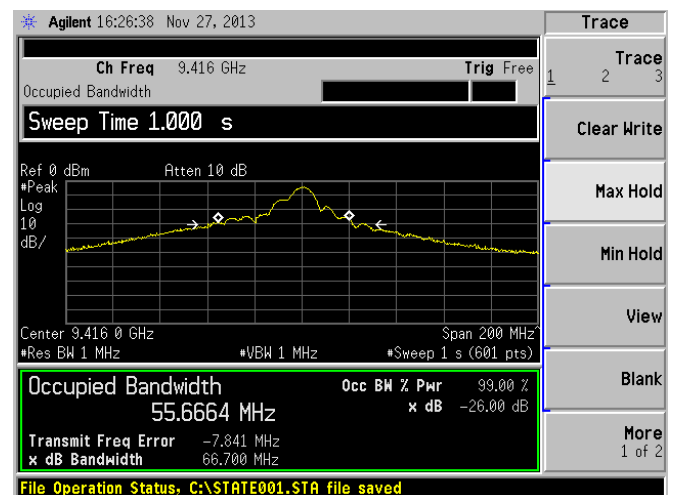
27th Nov., 2013

TESTED BY T. Ito

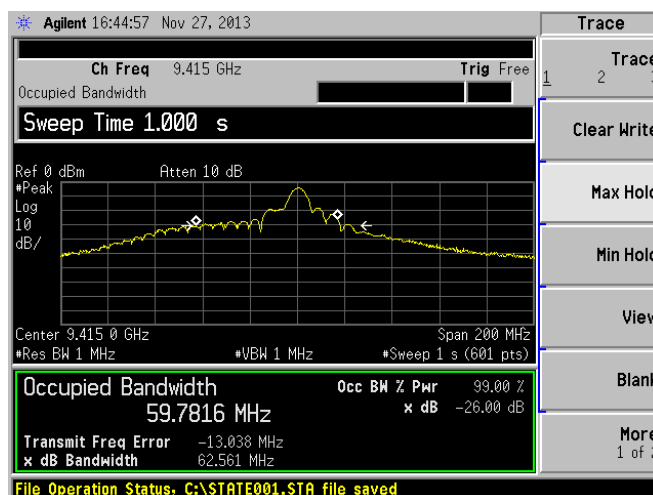
4.4.8 TEST RESULTS



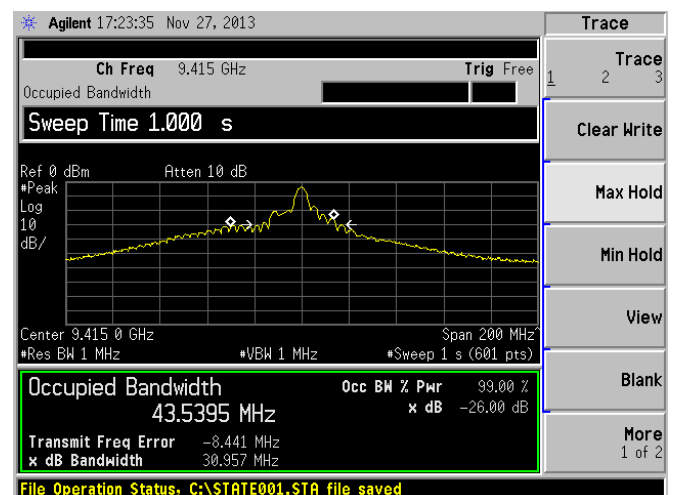
OBW for a SP1



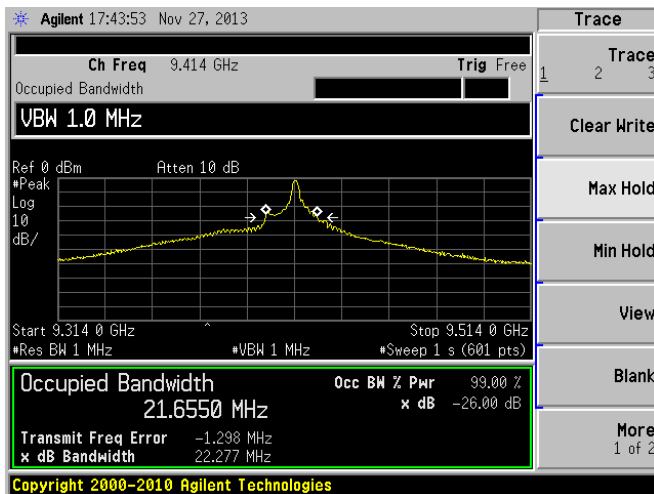
OBW for a SP2



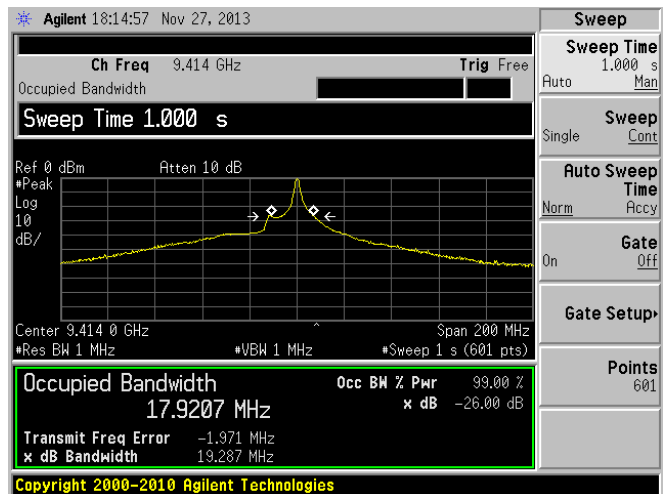
OBW for a SP3



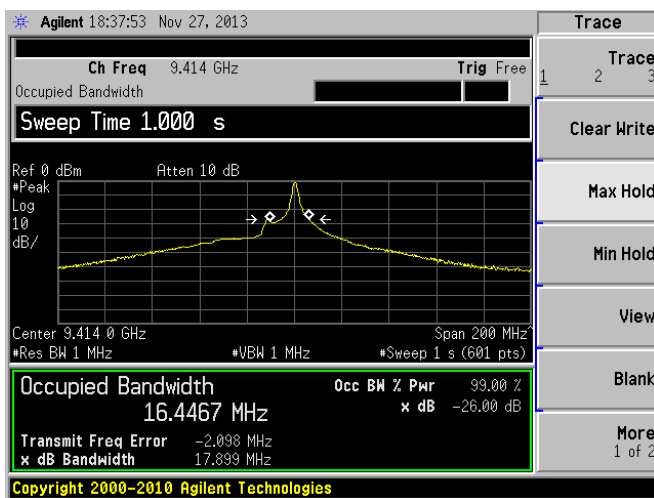
OBW for a MP1



OBW for a MP2



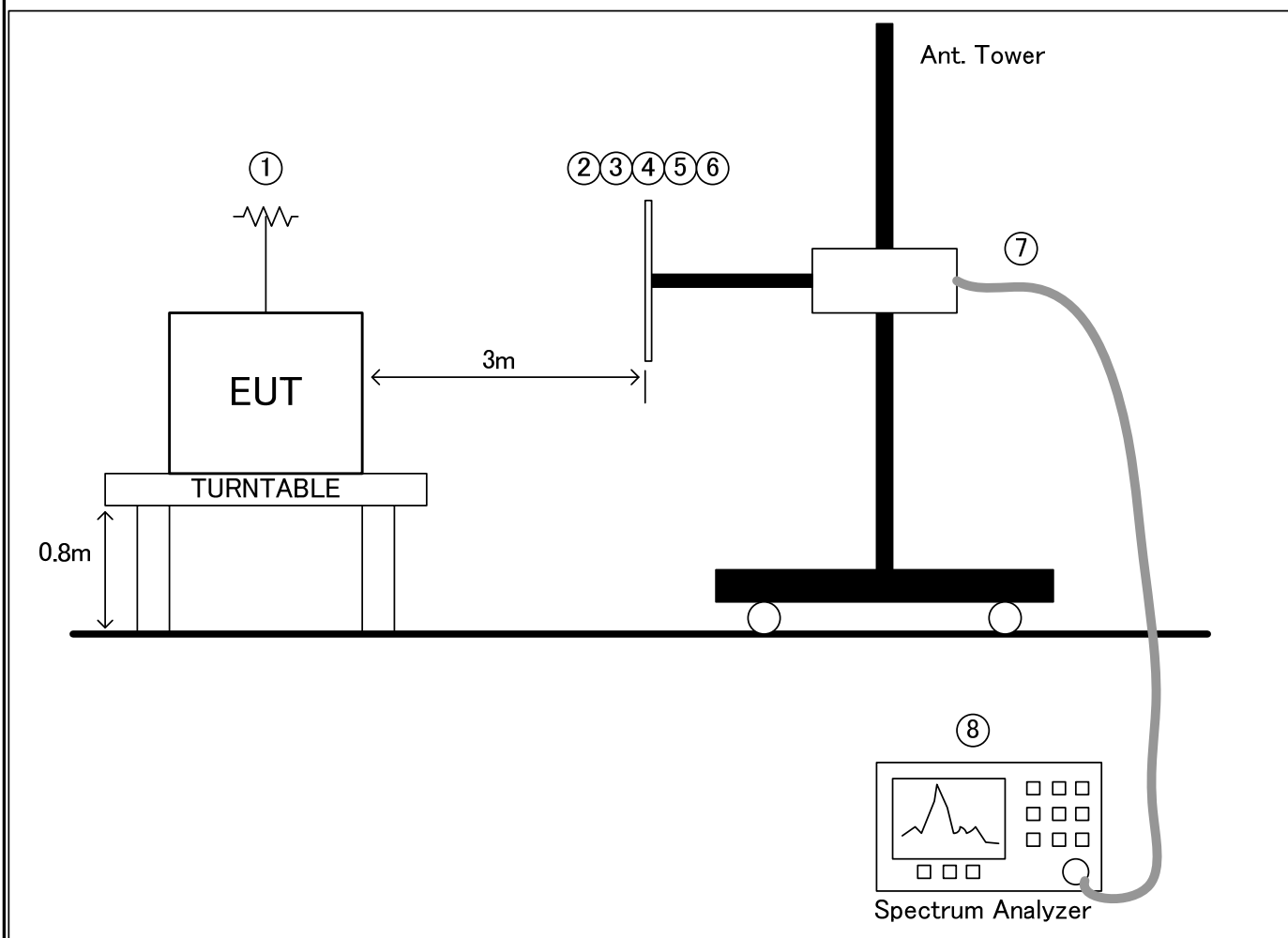
OBW for a LP1



OBW for a LP2

4.5 Field strength of spurious radiation

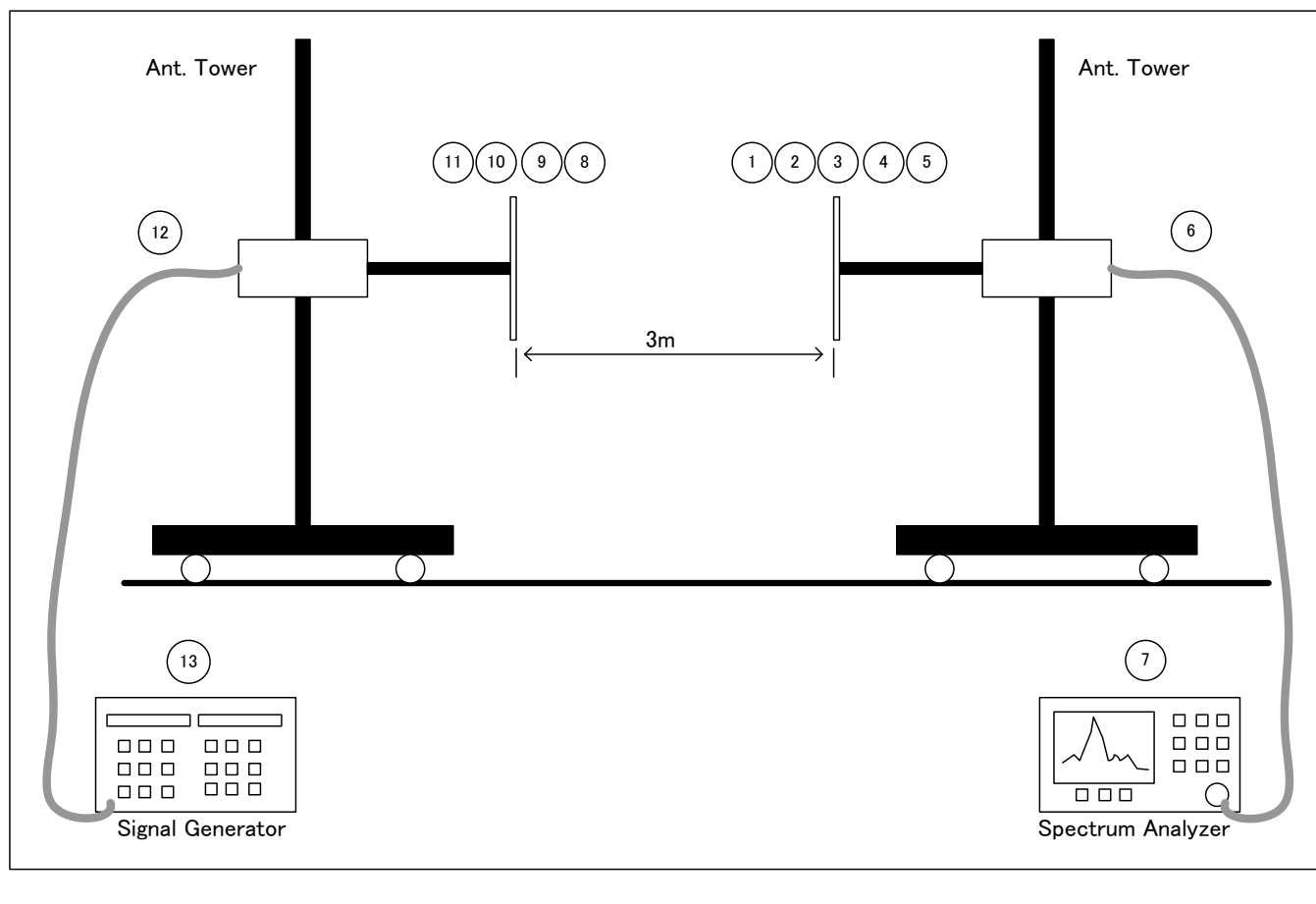
4.5.1.1 TEST SETUP for measuring the radiated spurious emission from the EUT.



4.5.1.2 TEST INSTRUMENT

	DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATION DATE	CALIBRATION DUE DATE
1	High Power Dummy Load PASTERNAK	PE6824	NA	NA	NA
2	Biconical Schwazbeck	BBA9106	VHA91031979	Aug. 5 th 2013	Aug. 2014
3	Logarithmic Periodic Schwazbeck	UHALP9107	91071291	Feb 16 nd 2013	Feb 2014
4	Double Ridge Horn ETS LINDGREN	3117	00091928	Oct. 11 th 2013	Oct. 2014
5	Standard Gain Horn Flann	20240	NA	NA	NA
6	Standard Gain Horn Flann	22240	NA	NA	NA
7	Coaxial Cable Gore	0G0S10S1059	NA	NA	NA
8	Spectrum Analyzer Agilent	E4448A	MY50180037	Nov. 20 st 2013	Nov. 2014

4.5.2.1 TEST SETUP for measuring the level of particular spurious frequency from Signal Generator.



4.5.2.2 TEST INSTRUMENT

	DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATION DATE	CALIBRATION DUE DATE
1	Biconical Schwazbeck	BBA9106	VHA91031979	Aug. 5 th 2013	Aug. 2014
2	Logarithmic Periodic Schwazbeck	UHALP9107	91071291	Feb 16 nd 2013	Feb 2014
3	Double Ridge Horn ETS LINDGREN	3117	00091928	Oct. 11 th 2013	Oct. 2012
4	Standard Gain Horn Flann	20240	NA	NA	NA
5	Standard Gain Horn Flann	22240	NA	NA	NA
6	Coaxial Cable Gore	0G0S10S1059	NA	NA	NA
7	Spectrum Analyzer Agilent	E4448A	MY50180037	Nov. 20 st 2013	Nov.. 2014
8	Dipole Schwazbeck	UHA9105	NA	Feb. 16 st 2013	Feb. 2014
9	Logarithmic Periodic EATON	94612-1	0203	NA	NA
10	Standard Gain Horn Flann	20240	NA	NA	NA
11	Standard Gain Horn Flann	22240	NA	NA	NA
12	Coaxial Cable Gore	0G0S10S1059	NA	NA	NA
13	Signal Generator Agilent	83640B	3844A00847	Jul. 16 th 2013	Jul. 2014

Measurement Point : Antenna terminal

Spectrum Analyzer setting: RBW = 10kHz less than 1GHz, 1MHz above 1GHz

VBW = 300kHz less than 1GHz, 3MHz above 1GHz

Detector Mode = Positive Peak

4.5.3 TEST PROCEDURES

- Reference to Section 2.2.12 Unwanted Emission: Radiated Spurious on TIA-603-C.
- The average power was calculated based on the standard formula for radar systems.

Average power= Pulse width * Pulse rep rate *Peak power

In case of NKE-2044, Average power for each pulses are following.

PW [usec] / PRF [Hz]	Average Power[W]
0.08 / 4000	1.19
0.08 / 2250	0.68
0.13 / 1700	0.87
0.25 / 1700	1.39
0.5 / 1200	2.02
0.8 / 750	2.04
1.0 / 650	2.21

c. Transmitted at most powerful pulse on average power is 1.0us/650Hz at 10kHz to 40GHz.

4.5.4 MINIMUM STANDARD

Frequency < 9300MHz: Emissions < -25dBc

9500MHz < Frequency < 23750MHz: Emissions < -35dBc

Frequency > 23750MHz: Emissions < -47.2dBc

4.5.5 TEST RESULTS

No spurious emissions observed above minimum standard.

Test data is described at section 4.5.10.

4.5.6 TEST CONDITIONS

T_{amb} = 20°C to 25°C, RH_{amb} = 40% ~ 60%

EUT input = 12 VDC

4.5.7 STABILIZATION

EUT energized for 10 minutes minimum.

4.5.8 TEST EQUIPMENT

JRC Original – Shielded Room

Other equipment – see test set-up.

4.5.9 DATE

27, November 2013

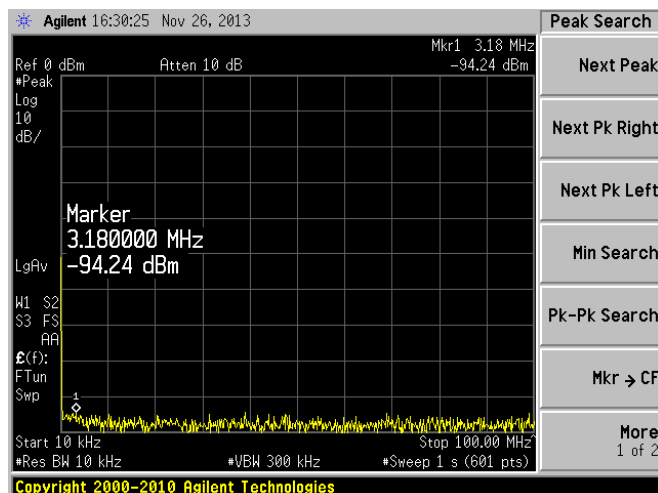
TEST ENGINEER: T. Ito

4.5.10.1 TEST RESULTS of Dark Noise

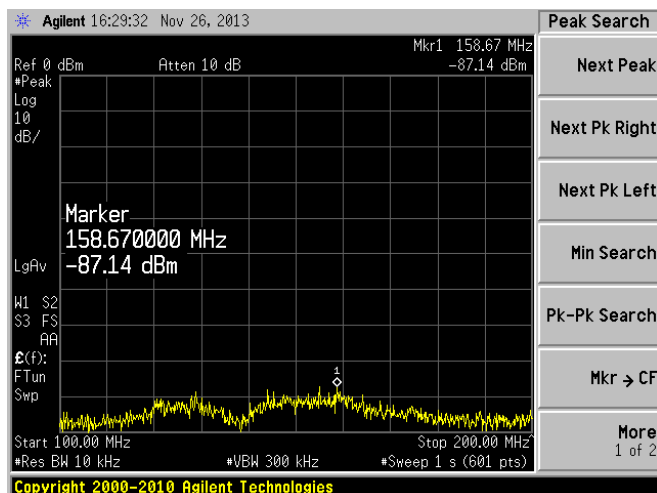
Horizontal Polarized Dark noise							
Range	Frequency [MHz]	level [dBm]	Pg [dBm]	Cable Loss [dB]	Antenna Gain [dB]	Pd [dBm]	Radiated Spurious Emission [dBc]
10kHz – 100MHz	3.18	-94.24	-73.7	0.18	1	-72.88	-138.3
100MHz – 200MHz	158.67	-87.14	-68.25	0.32	1	-67.57	-133
200MHz – 300MHz	215.67	-92.67	-70.17	0.38	1	-69.55	-135
300MHz – 400MHz	371.17	-93.41	-61.4	0.47	5	-56.87	-122.3
400MHz – 500MHz	462.17	-92.88	-48.49	0.50	5	-43.99	-10.94
500MHz – 600MHz	553.83	-93.18	-56.44	0.62	5	-52.06	-117.5
600MHz – 700MHz	699.67	-93.04	-58.62	0.70	5	-54.32	-119.7
700MHz – 800MHz	739.33	-92.95	-52.16	0.70	5	-47.86	-113.3
800MHz – 900MHz	813.00	-92.86	-45.26	0.76	5	-41.02	-106.4
900MHz – 1.0GHz	969.17	-93.45	-54.79	0.81	5	-50.6	-116
1.0GHz – 2.9GHz	2880	-69.91	-45.11	1.29	6	-40.4	-105.8
2.9GHz – 6.4GHz	2920	-67.74	-34.75	2.14	6	-30.9	-96.33
6.4GHz – 12.5GHz	12400	-63.92	-27.66	3.74	12.5	-18.9	-84.33
11.9G – 18GHz	15540	-61.17	-18.49	3.85	13	-9.34	-74.77
17.6G – 26.7GHz	25500	-58.75	-48.48	3.92	20	-32.4	-97.83
26.7G – 40.0GHz	39030	-48.21	-28.57	4.44	20	-13.01	-78.44

Vertical Polarized Dark noise							
Range	Frequency [MHz]	level [dBm]	Pg [dBm]	Cable Loss [dB]	Antenna Gain [dB]	Pd [dBm]	Radiated Spurious Emission [dBc]
10kHz – 100MHz	3.68	-93.53	-77.91	0.18	1	-77.09	-142.5
100MHz – 200MHz	141.67	-85.95	-69.46	0.32	1	-68.78	-134.2
200MHz – 300MHz	299.67	-92.89	-59.57	0.38	1	-58.95	-124.4
300MHz – 400MHz	389.17	-93.19	-60.46	0.47	5	-55.93	-121.4
400MHz – 500MHz	482.67	-92.67	-56.75	0.50	5	-52.25	-117.7
500MHz – 600MHz	566.33	-92.93	-50.52	0.62	5	-46.14	-111.6
600MHz – 700MHz	633.00	-92.96	-52.29	0.70	5	-47.99	-113.4
700MHz – 800MHz	746.00	-92.43	-53.39	0.70	5	-49.09	-114.5
800MHz – 900MHz	821.17	-93.25	-49.40	0.76	5	-45.16	-110.6
900MHz – 1.0GHz	971.00	-92.13	-44.84	0.81	5	-40.65	-106.1
1.0GHz – 2.9GHz	2400	-69.86	-42.82	1.29	6	-38.11	-103.5
2.9GHz – 6.4GHz	2900	-67.33	-35.32	2.14	6	-31.46	-96.89
6.4GHz – 12.5GHz	12500	-63.86	-28.42	3.74	12.5	-19.66	-85.09
11.9G – 18GHz	13300	-61.03	-14.91	3.85	13	-5.76	-71.19
17.6G – 26.7GHz	25800	-57.84	-45.48	3.92	20	-29.4	-94.83
26.7G – 40.0GHz	39900	-48.62	-30.10	4.44	20	-14.54	-79.97

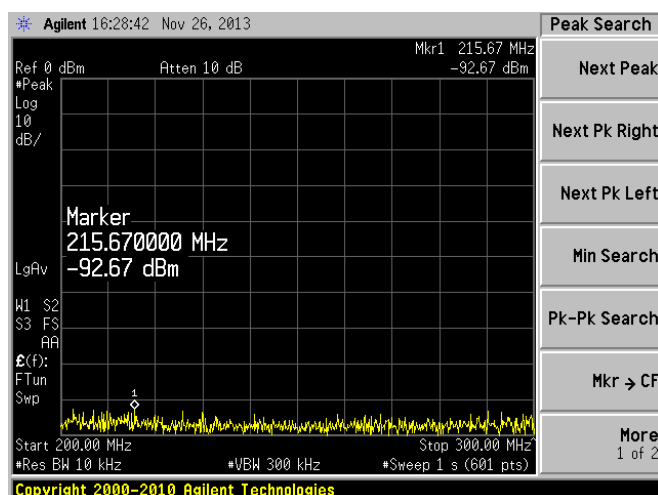
Horizontal Polarized



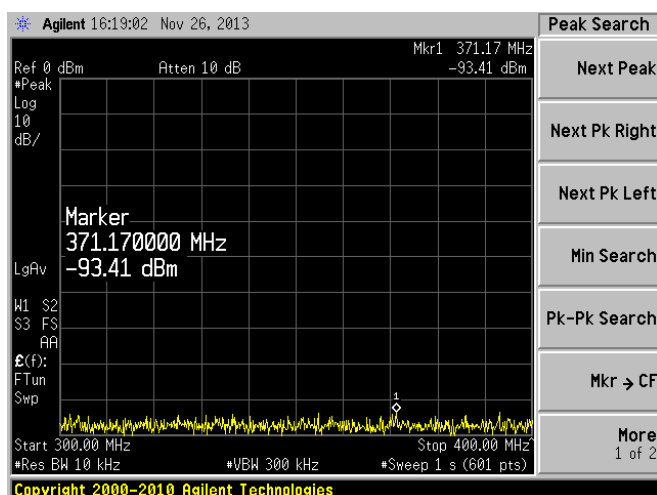
10kHz to 100MHz



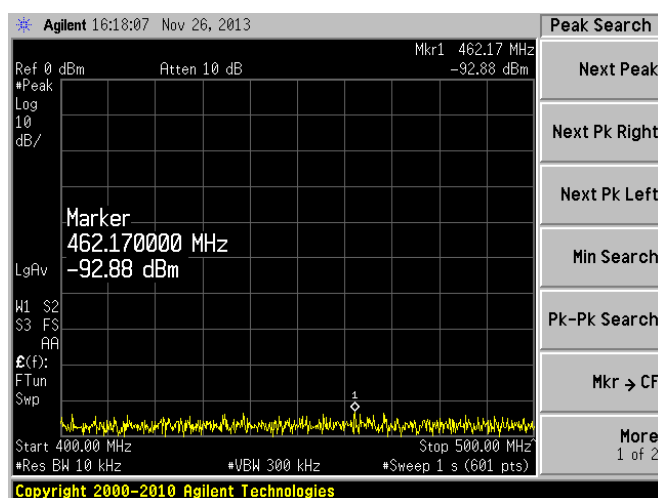
100MHz to 200MHz



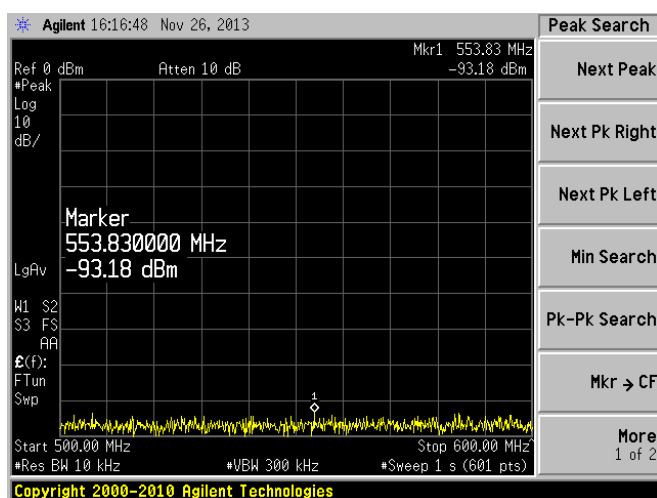
200MHz to 300MHz



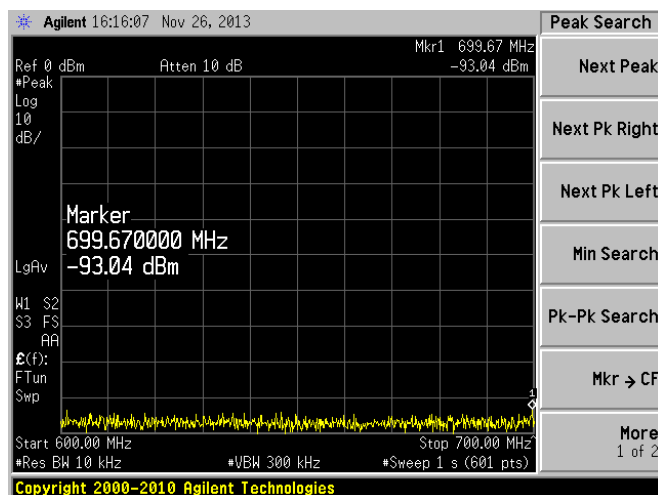
300MHz to 400MHz



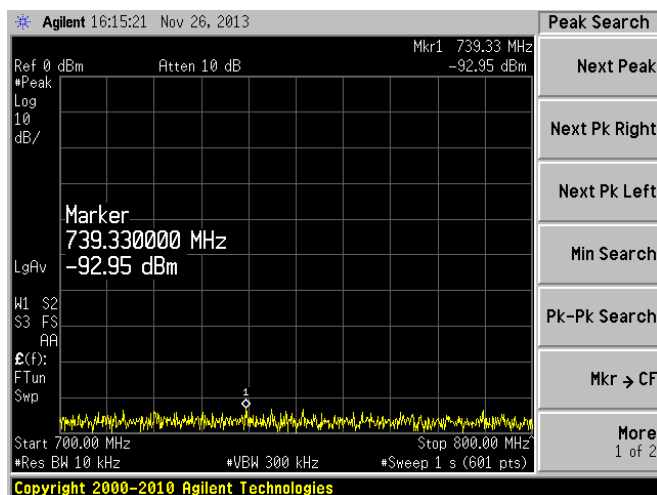
400MHz to 500MHz



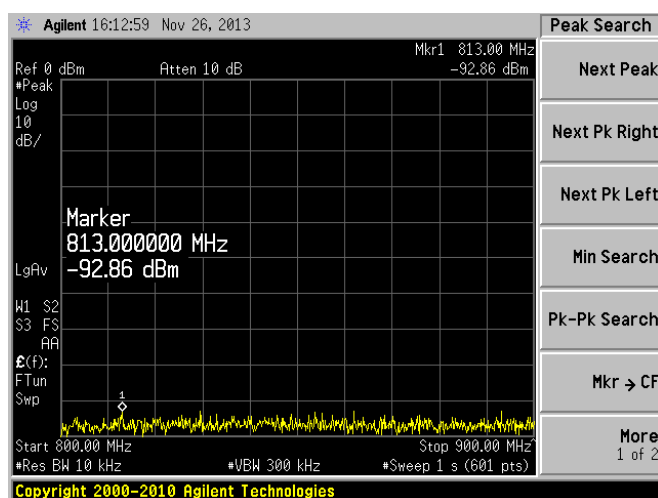
500MHz to 600MHz



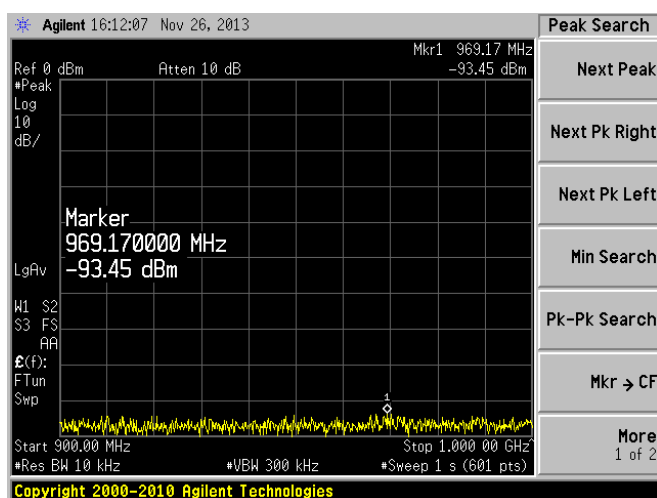
600MHz to 700MHz



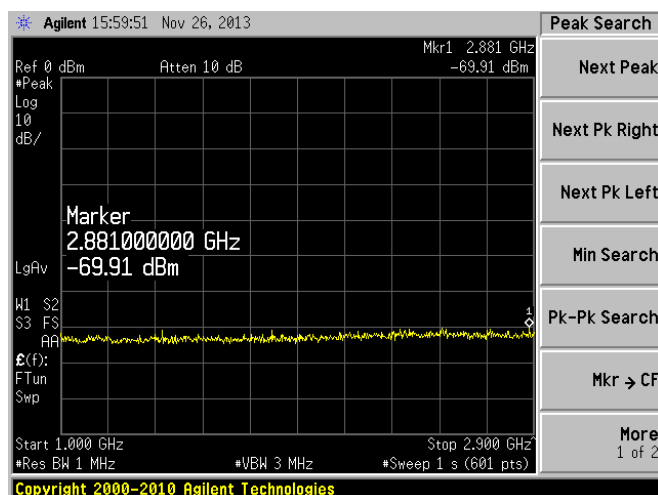
700MHz to 800MHz



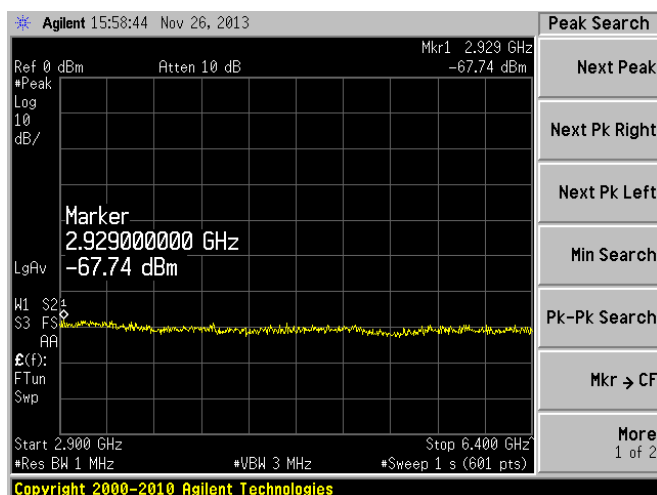
800MHz to 900MHz



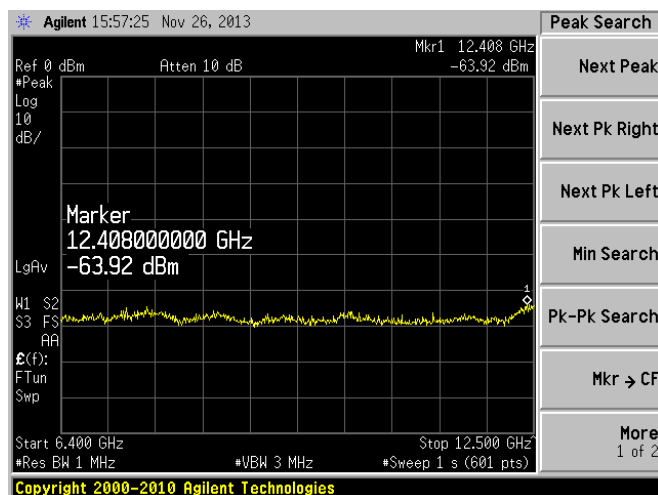
900MHz to 1GHz



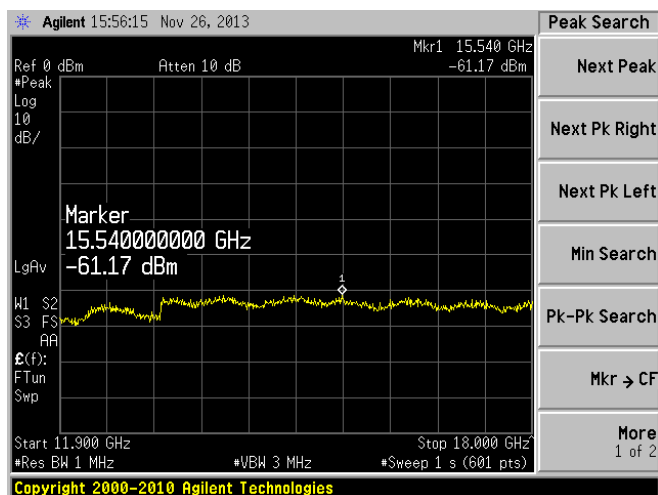
1GHz to 2.9GHz



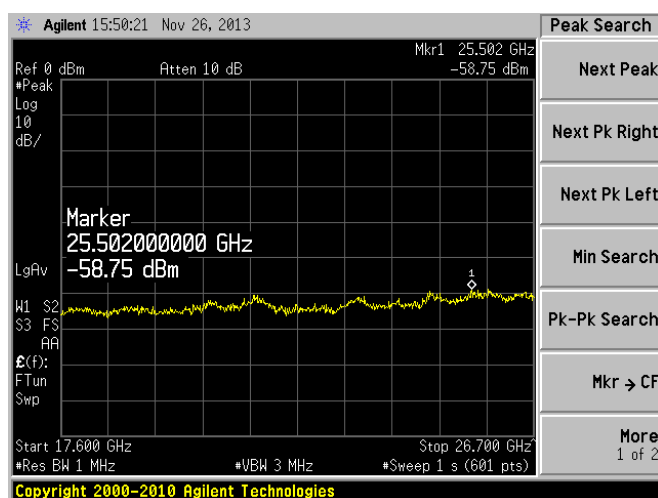
2.9GHz to 6.4GHz



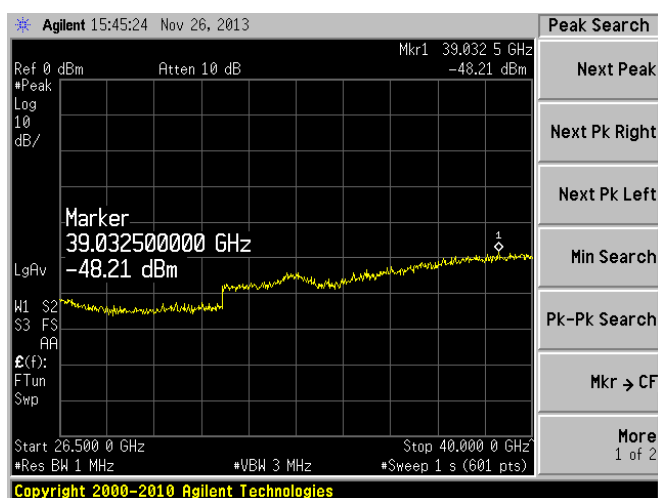
6.4GHz to 12.5GHz



11.9GHz to 18GHz

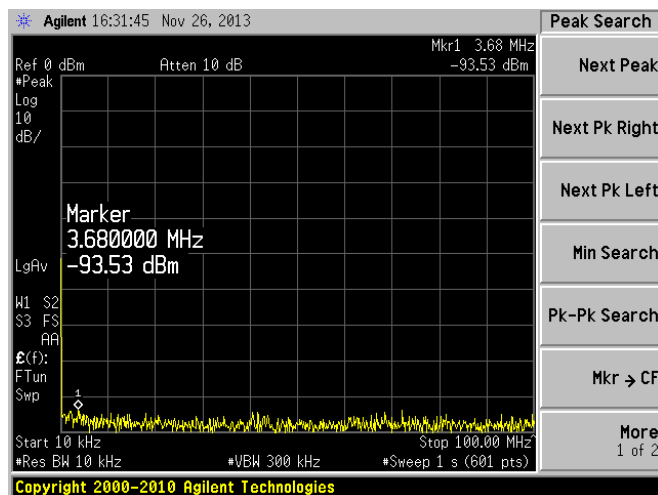


17.6GHz to 26.7GHz

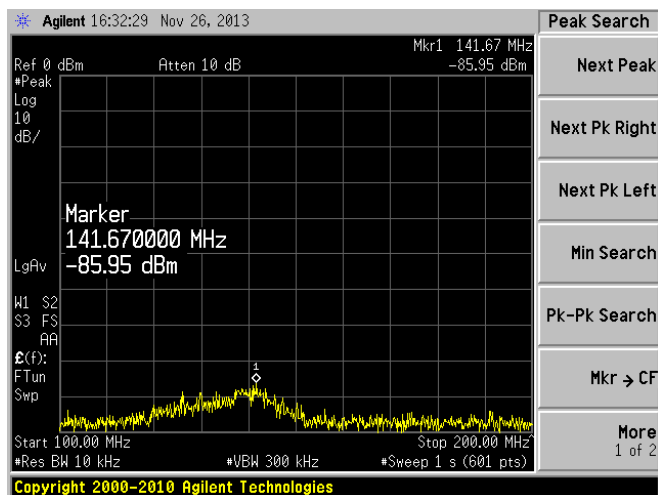


26.5GHz to 40.0GHz

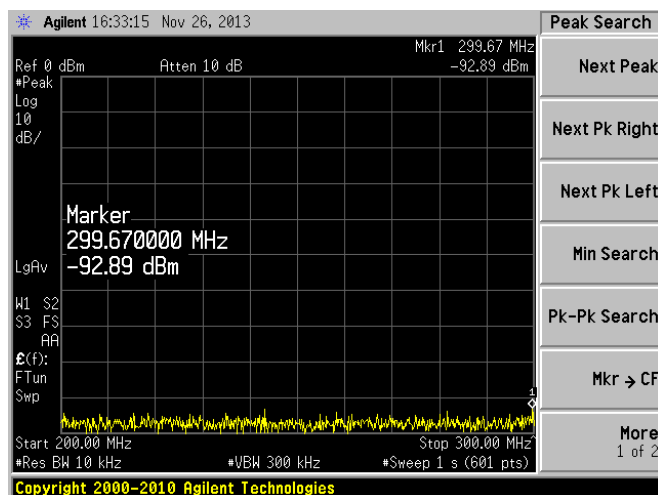
• Vertical Polarized



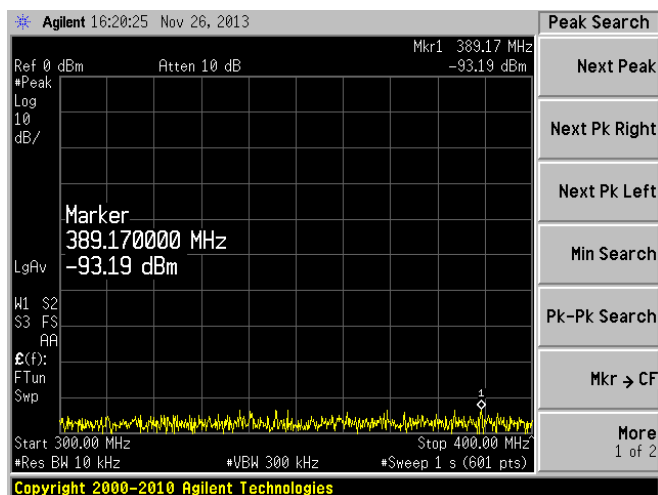
10kHz to 100MHz



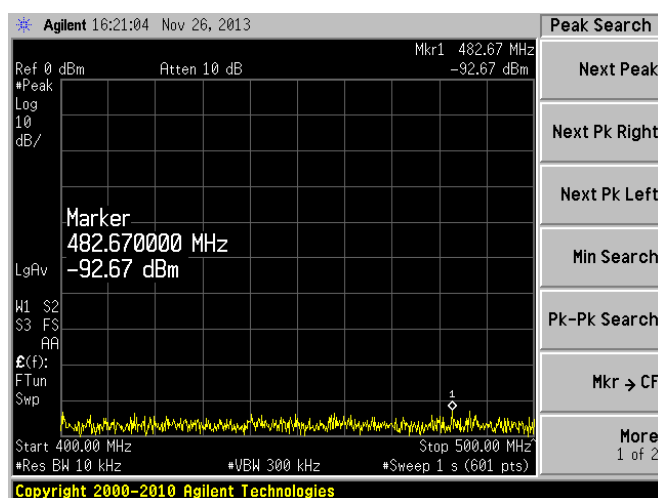
100MHz to 200MHz



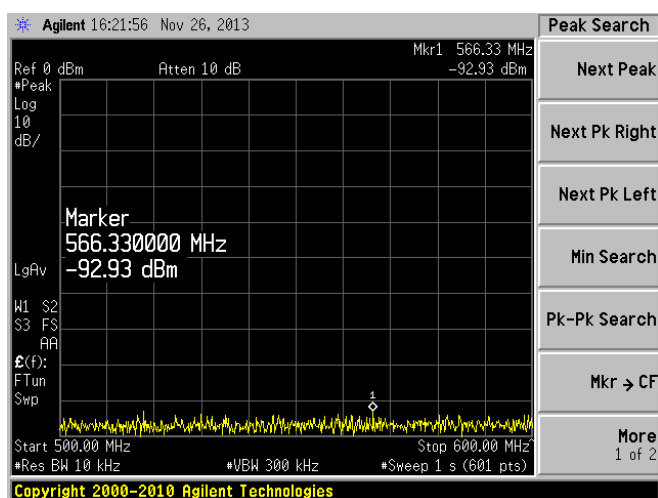
200MHz to 300MHz



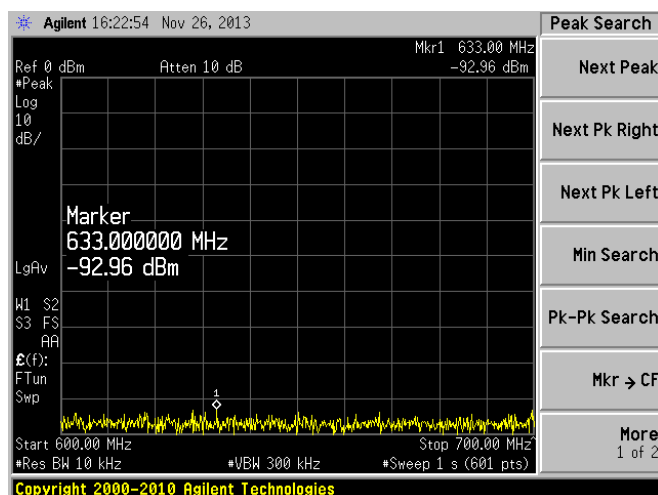
300MHz to 400MHz



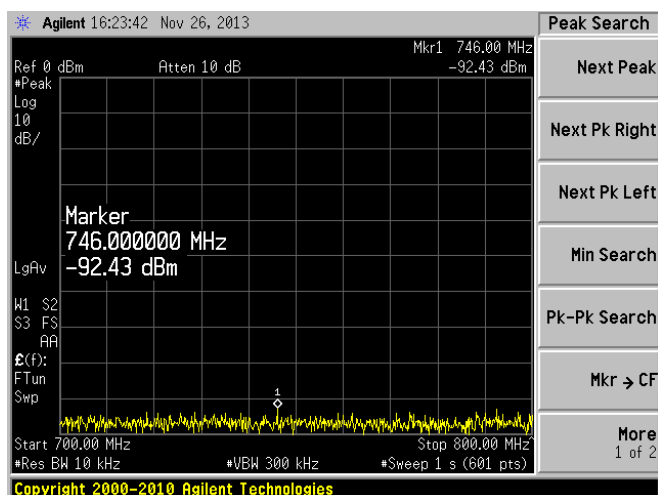
400MHz to 500MHz



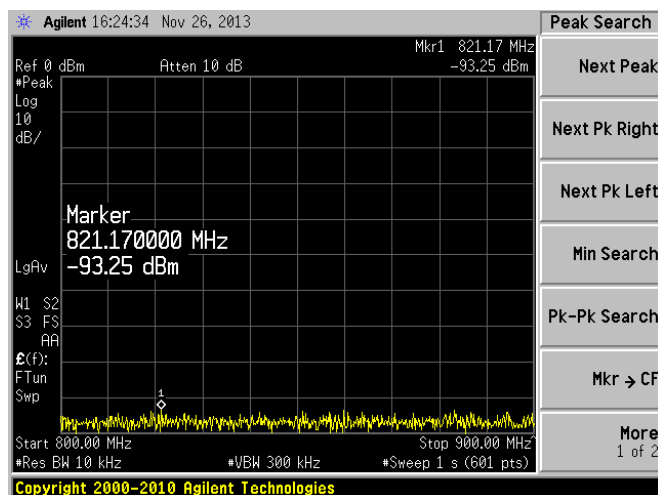
500MHz to 600MHz



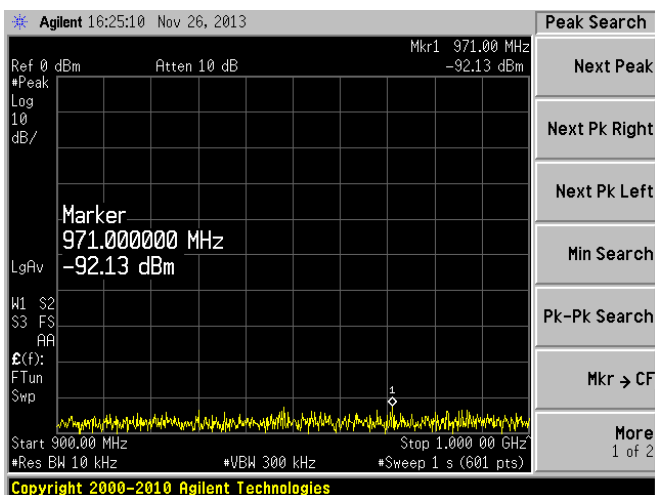
600MHz to 700MHz



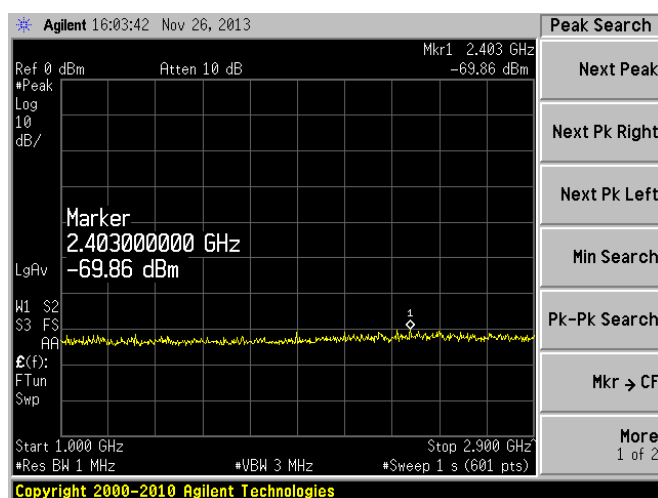
700MHz to 800MHz



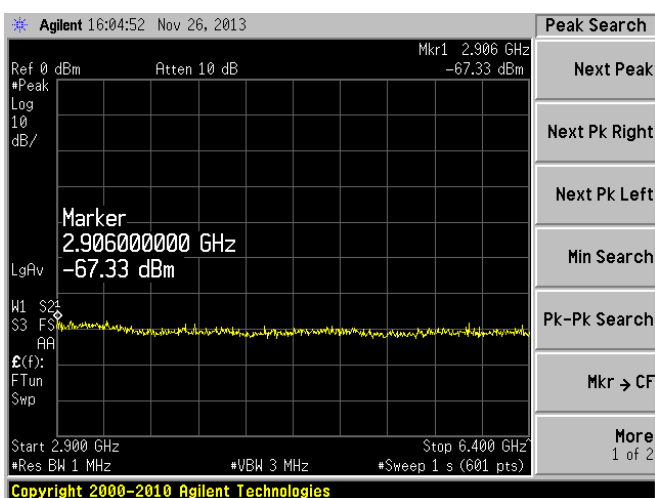
800MHz to 900MHz



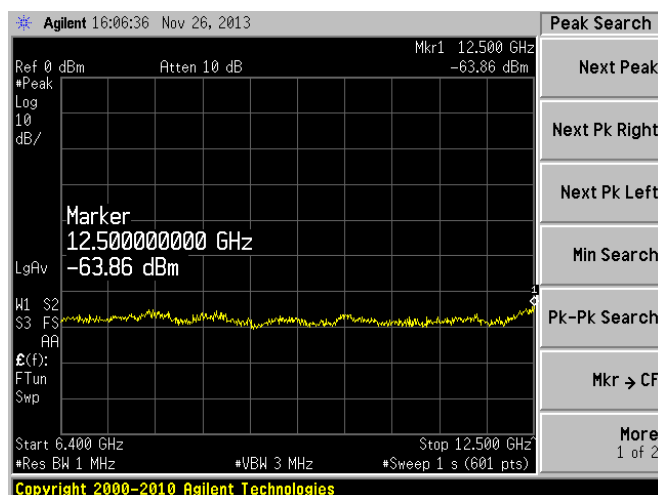
900MHz to 1GHz



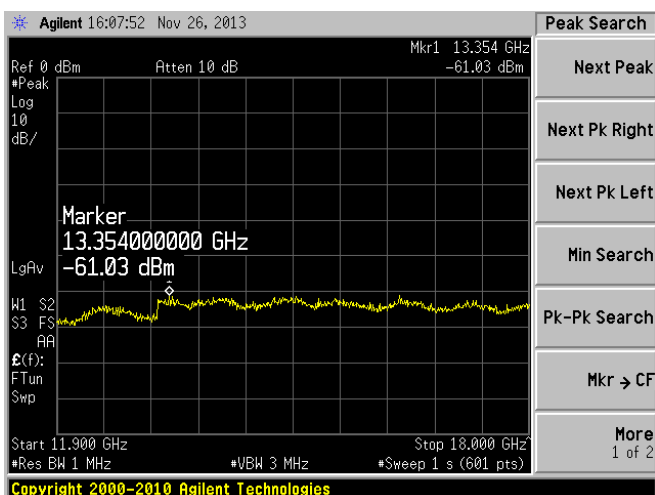
1GHz to 2.9GHz



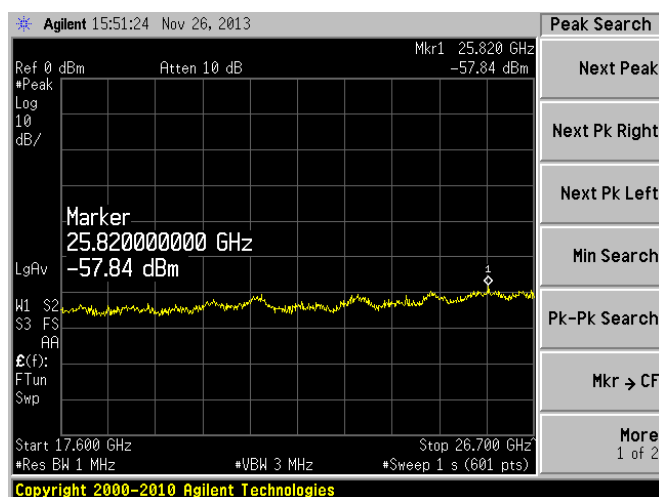
2.9GHz 6.4GHz



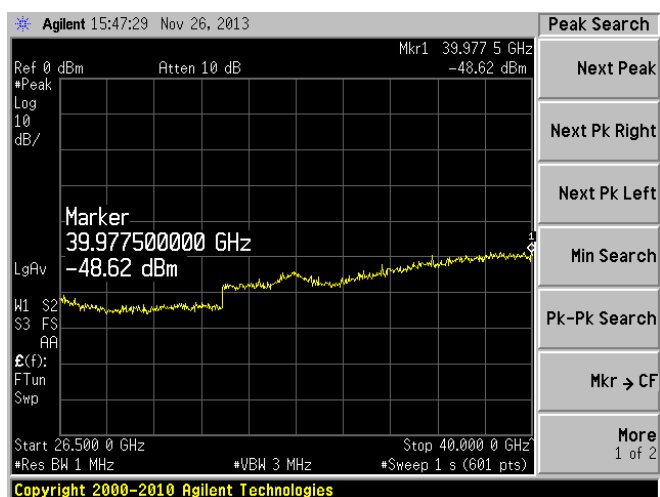
6.4GHz to 12.5GHz



11.9GHz to 18.0GHz



17.6GHz to 26.7GHz



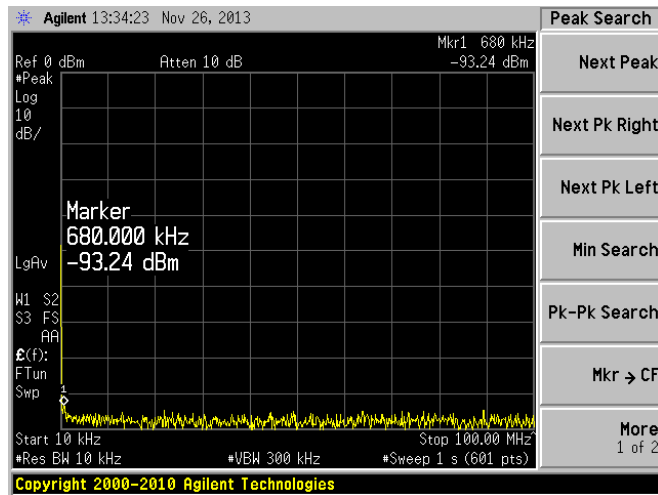
26.4GHz to 40GHz

4.5.10.2 TEST RESULTS of STBY

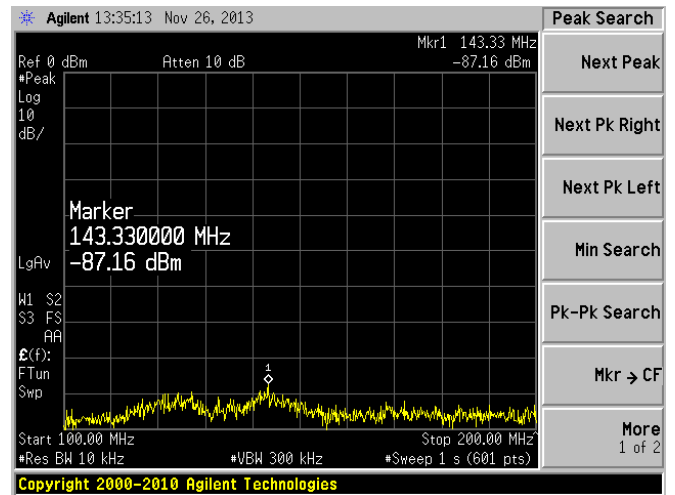
Horizontal Polarized STBY							
Range	Frequency [MHz]	level [dBm]	Pg [dBm]	Cable Loss [dB]	Antenna Gain [dB]	Pd [dBm]	Radiated Spurious Emission [dBc]
10kHz - 100MHz	680	-93.24	-72.7	0.18	1	-71.88	-137.3
100MHz - 200MHz	143.33	-87.16	-68.27	0.32	1	-67.59	-133
200MHz - 300MHz	231.83	-92.19	-69.69	0.38	1	-69.07	-134.5
300MHz - 400MHz	390.67	-92.14	-60.13	0.47	5	-55.6	-121
400MHz - 500MHz	454.83	-92.75	-48.36	0.50	5	-43.86	-109.3
500MHz - 600MHz	540.83	-90.4	-53.66	0.62	5	-49.28	-114.7
600MHz - 700MHz	617	-92.25	-57.83	0.70	5	-53.53	-119
700MHz - 800MHz	760.5	-92.7	-51.91	0.70	5	-47.61	-113
800MHz - 900MHz	835.17	-92.74	-45.14	0.76	5	-40.9	-106.3
900MHz - 1.0GHz	981	-93.07	-54.41	0.81	5	-50.22	-115.6
1.0GHz - 2.9GHz	2520	-70.54	-45.74	1.29	6	-41.03	-106.5
2.9GHz - 6.4GHz	3087	-67.32	-34.34	2.14	6	-30.48	-95.91
6.4GHz - 12.5GHz	12368	-64.22	-27.96	3.74	12.5	-19.2	-84.63
11.9G - 18GHz	14889	-61.09	-18.41	3.85	13	-9.26	-74.69
17.6G - 26.7GHz	26700	-58.51	-48.24	3.92	20	-32.16	-97.59
26.7G - 40.0GHz	39753	-46.89	-27.25	4.44	20	-11.69	-77.12

Vertical Polarized STBY							
Range	Frequency [MHz]	level [dBm]	Pg [dBm]	Cable Loss [dB]	Antenna Gain [dB]	Pd [dBm]	Radiated Spurious Emission [dBc]
10kHz – 100MHz	98.33	-83.68	-68.06	0.18	1	-67.24	-132.7
100MHz – 200MHz	131	-87.28	-70.79	0.32	1	-70.11	-135.5
200MHz – 300MHz	229.33	-80.67	-47.35	0.38	1	-46.73	-112.2
300MHz – 400MHz	378.33	-92.89	-60.16	0.47	5	-55.63	-121.1
400MHz – 500MHz	421.67	-92.12	-56.2	0.50	5	-51.7	-117.1
500MHz – 600MHz	562.67	-93.04	-50.63	0.62	5	-46.25	-111.7
600MHz – 700MHz	688.17	-90.51	-49.84	0.70	5	-45.54	-111
700MHz – 800MHz	767.33	-92.08	-53.04	0.70	5	-48.74	-114.2
800MHz – 900MHz	818.83	-92.94	-49.09	0.76	5	-44.85	-110.3
900MHz – 1.0GHz	955	-93.38	-46.09	0.81	5	-41.9	-107.3
1.0GHz – 2.9GHz	2732	-69.98	-42.94	1.29	6	-38.23	-103.7
2.9GHz – 6.4GHz	3092	-67.96	-35.95	2.14	6	-32.09	-97.52
6.4GHz – 12.5GHz	12459	-64.33	-28.89	3.74	12.5	-20.13	-85.56
11.9G – 18GHz	14909	-60.92	-14.8	3.85	13	-5.65	-71.08
17.6G – 26.7GHz	26488	-58.73	-46.37	3.92	20	-30.29	-95.72
26.7G – 40.0GHz	39820	-48.62	-30.1	4.44	20	-14.54	-79.97

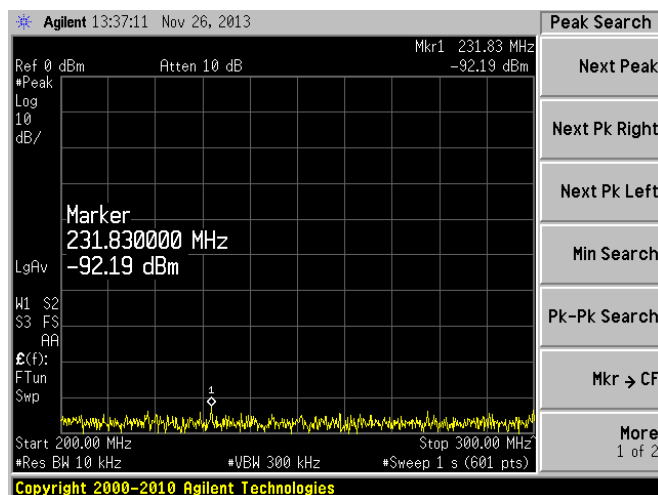
•Horizontal Polarized



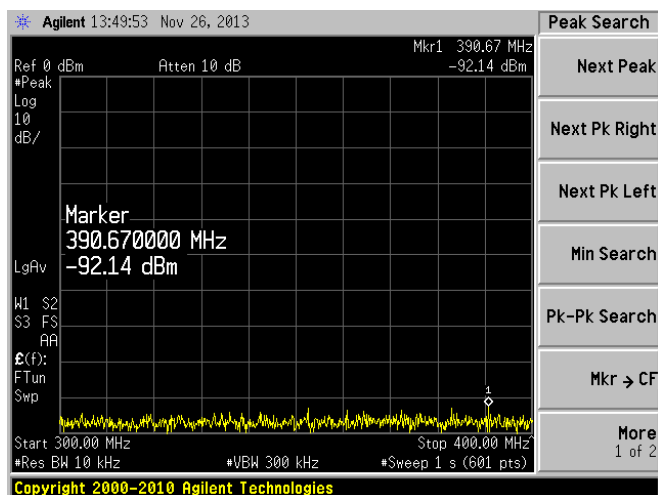
10kHz to 100MHz



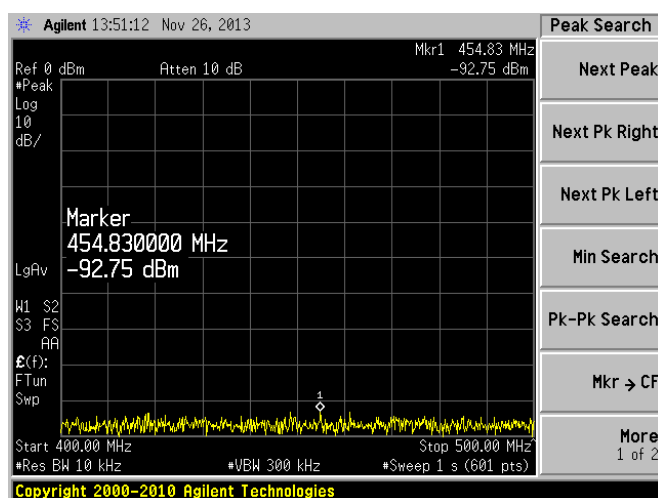
100MHz to 200MHz



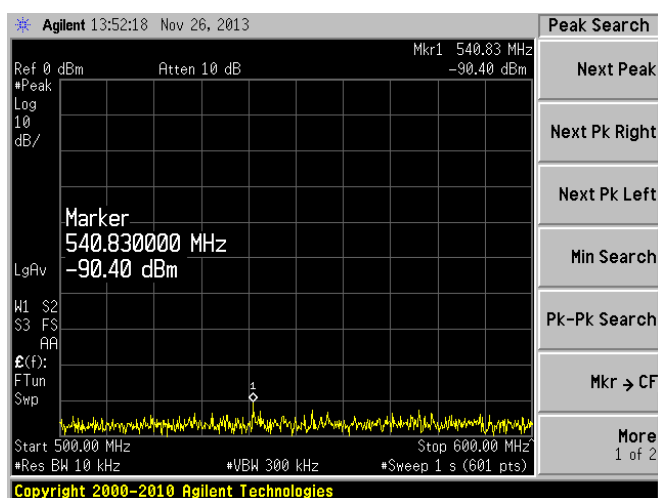
200MHz to 300MHz



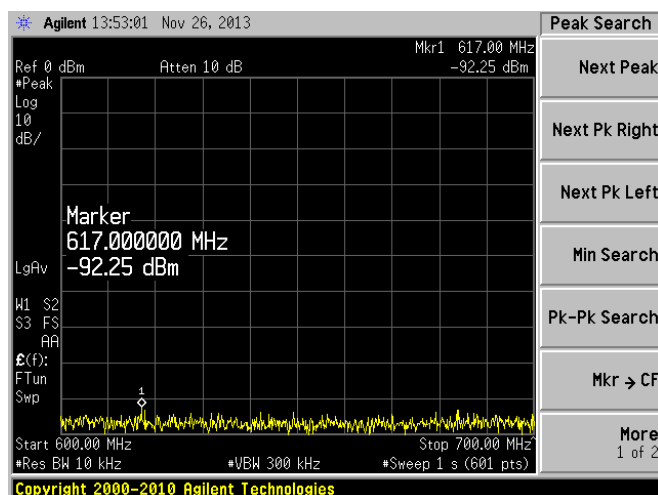
300MHz to 400MHz



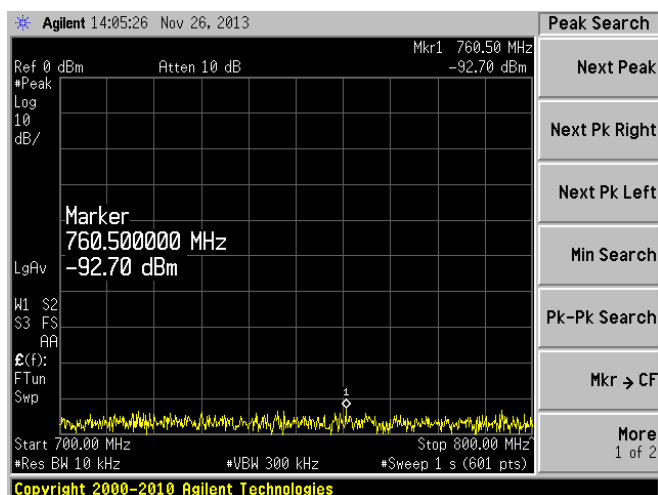
400MHz to 500MHz



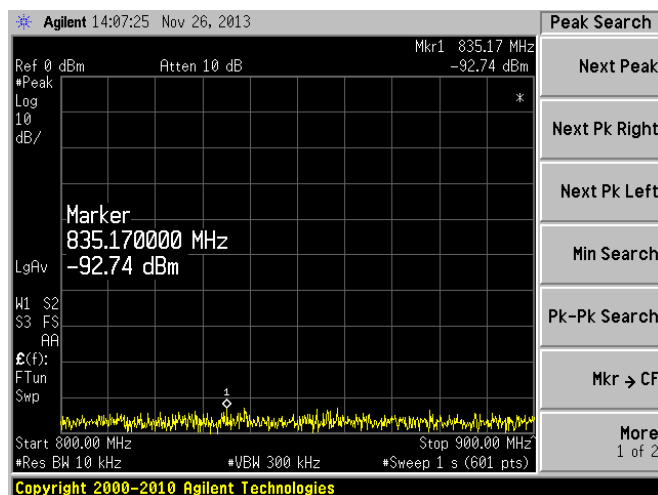
500MHz to 600MHz



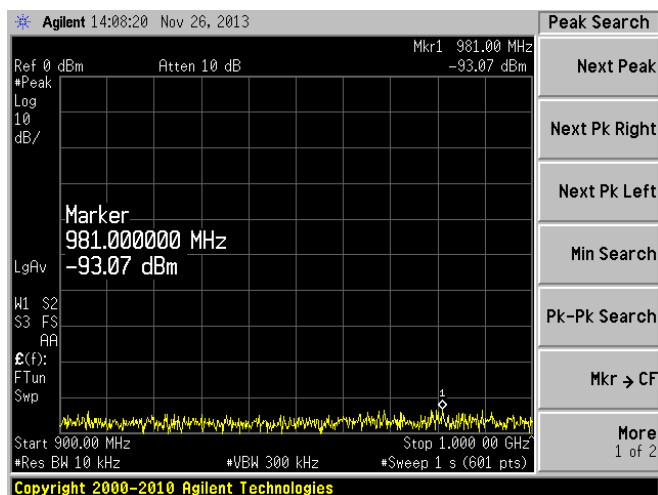
600MHz to 700MHz



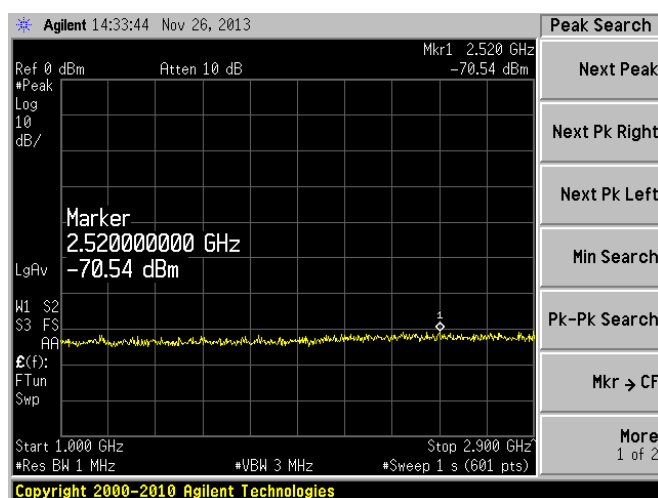
700MHz to 800MHz



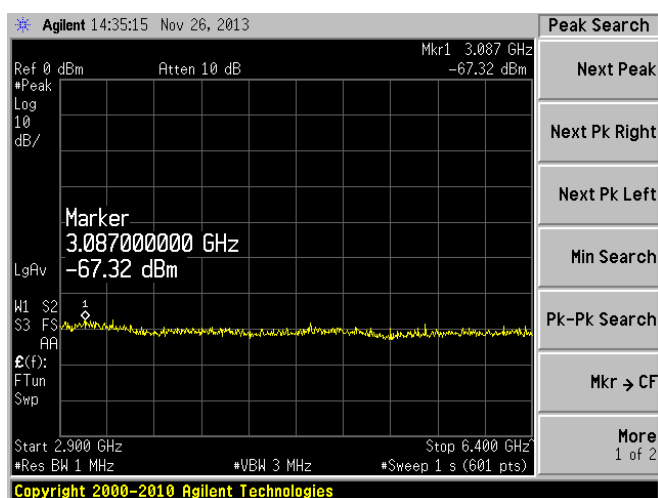
800MHz to 900MHz



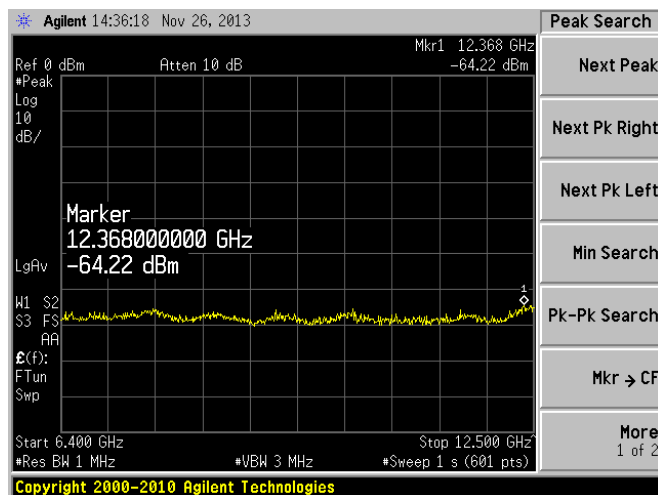
900MHz to 1GHz



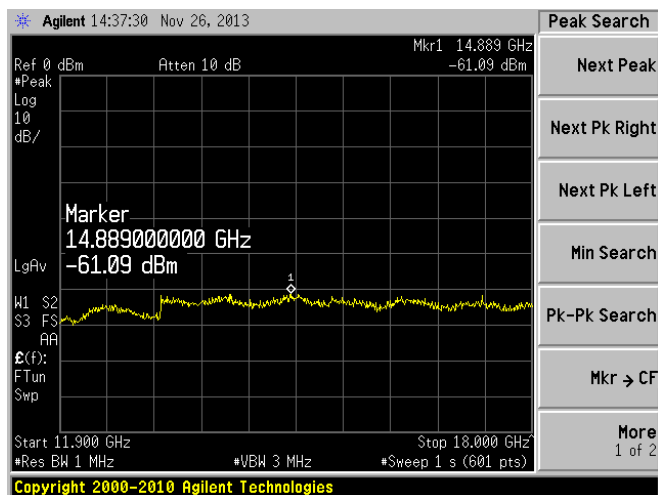
1GHz to 2.9GHz



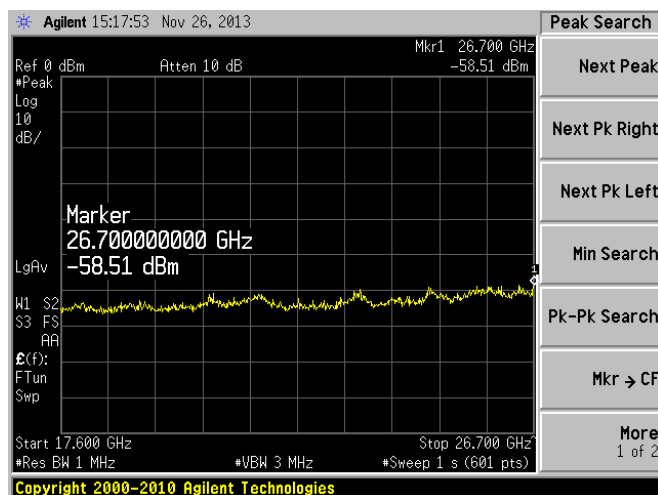
2.9GHz to 6.4GHz



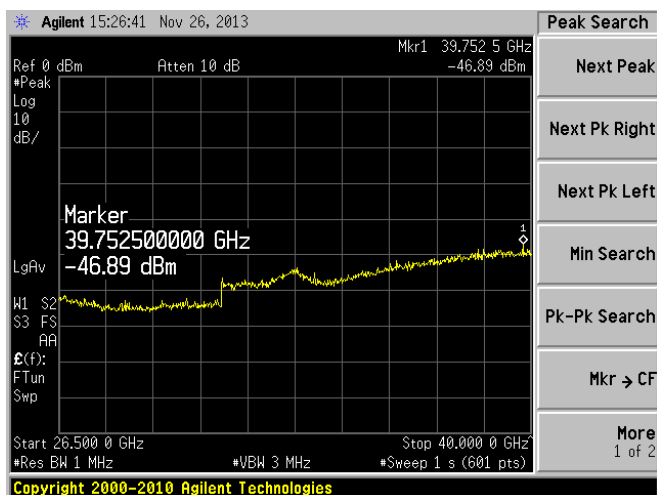
6.4GHz to 12.5GHz



11.9GHz to 18GHz

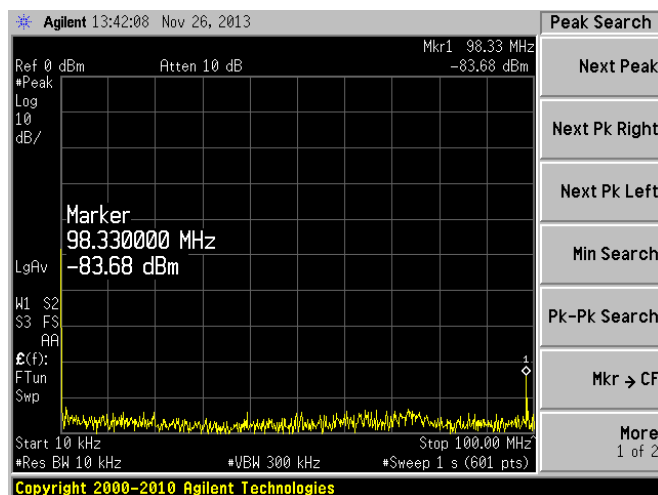


17.6GHz to 26.7GHz

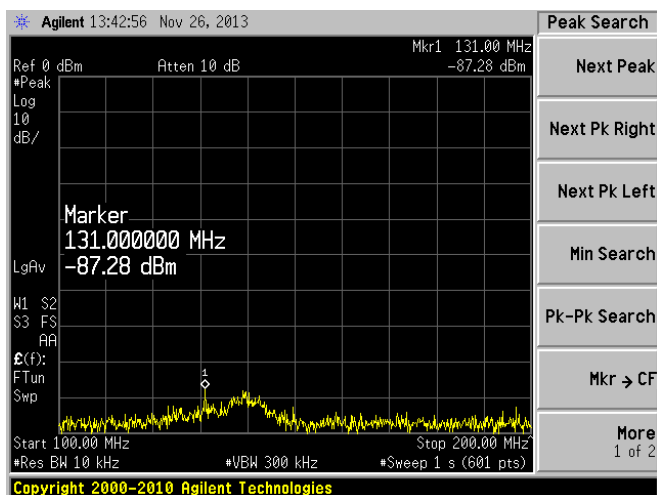


26.5GHz to 40.0GHz

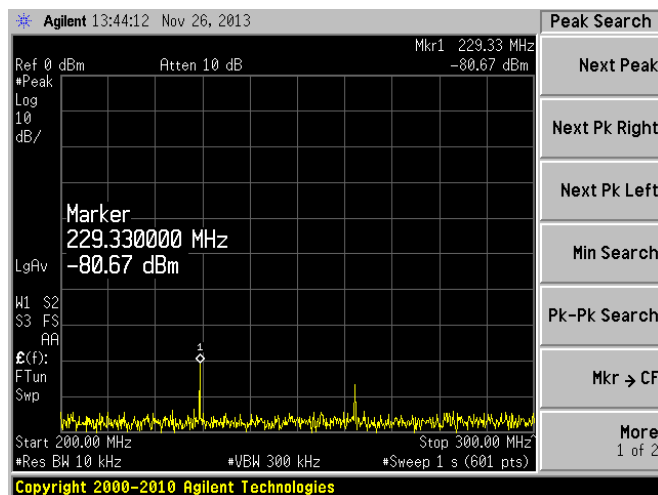
•Vertical Polarized



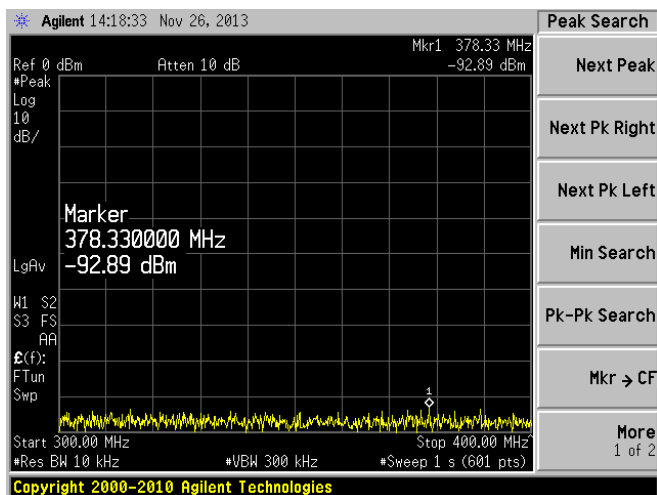
10kHz to 100MHz



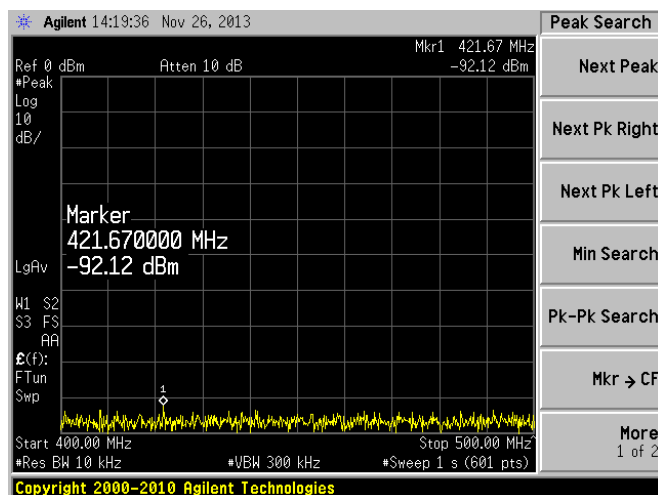
100MHz to 200MHz



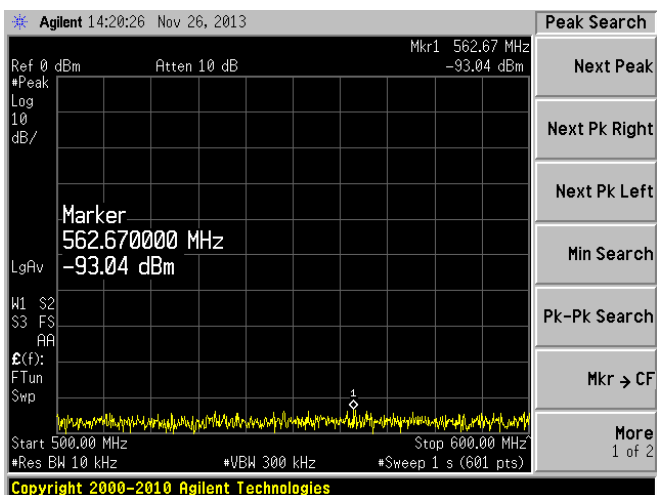
200MHz to 300MHz



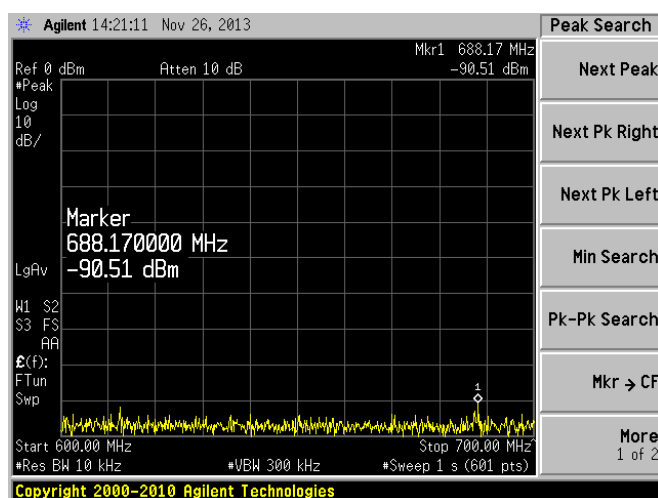
300MHz to 400MHz



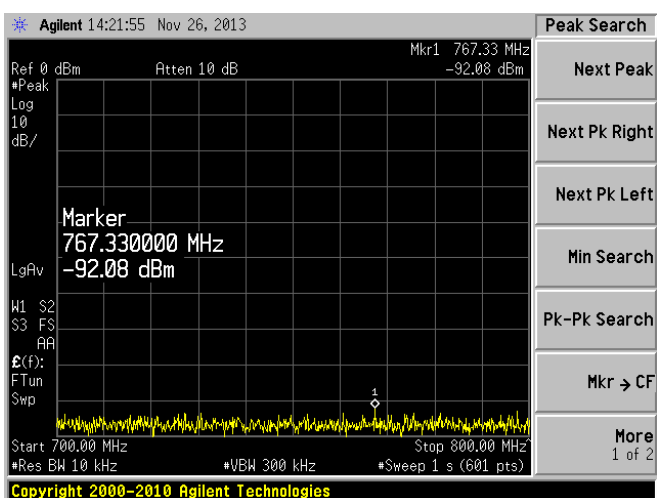
400MHz to 500MHz



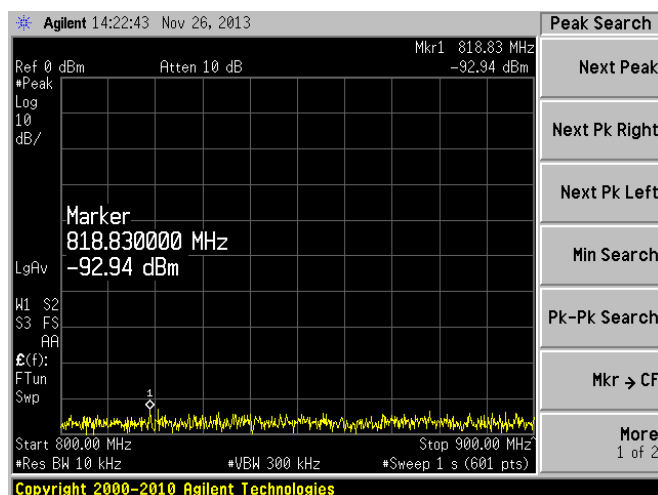
500MHz to 600MHz



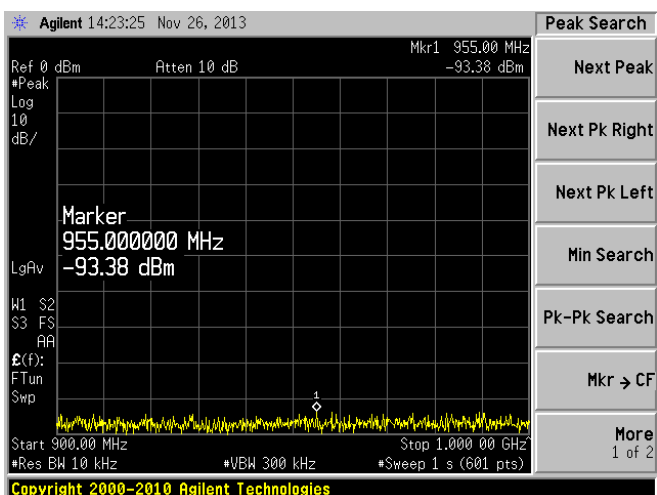
600MHz to 700MHz



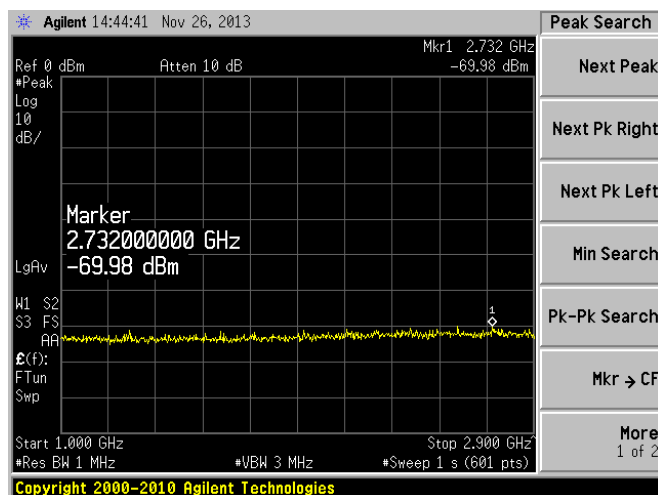
700MHz to 800MHz



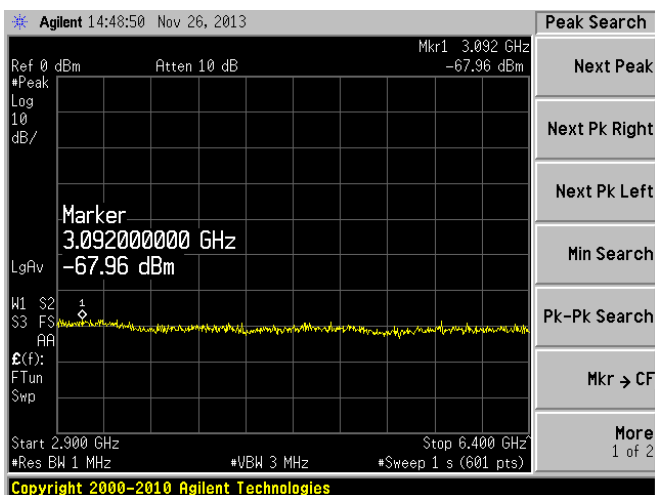
800MHz to 900MHz



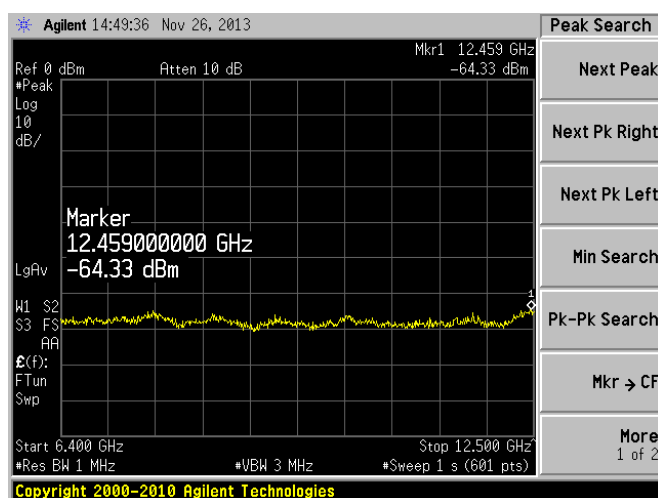
900MHz to 1GHz



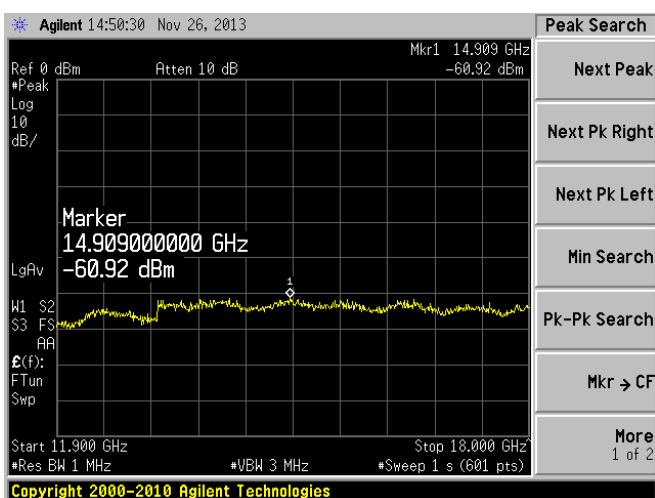
1GHz to 2.9GHz



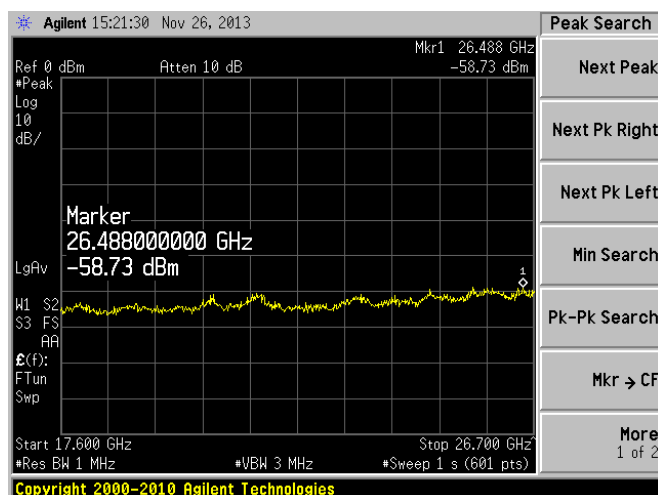
2.9GHz 6.4GHz



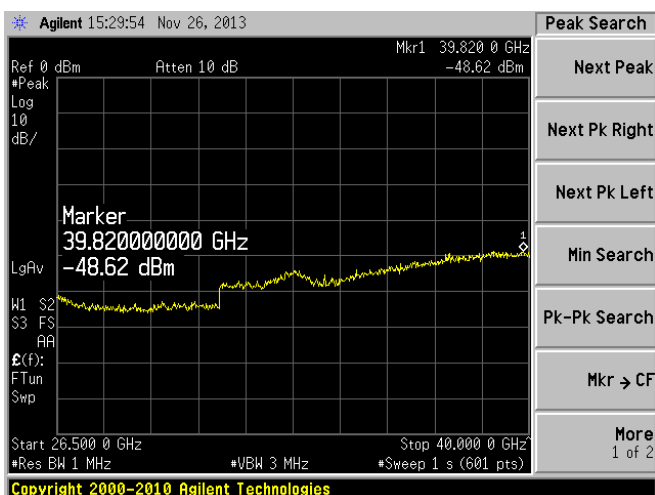
6.4GHz to 12.5GHz



11.9GHz to 18.0GHz



17.6GHz to 26.7GHz



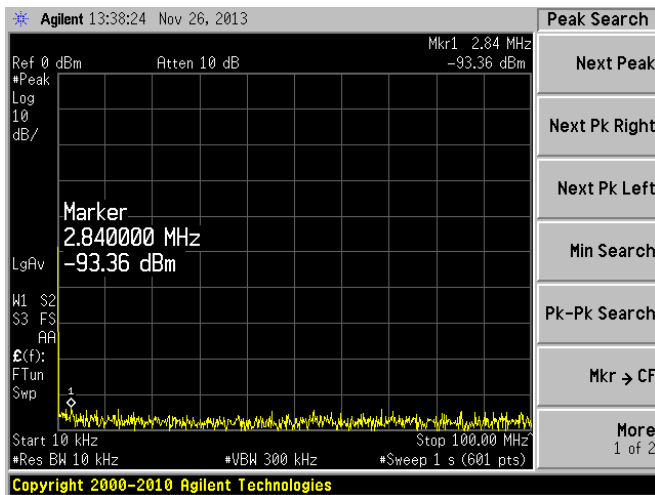
26.4GHz to 40GHz

4.5.10.3 TEST RESULTS of 1.0usec/650Hz

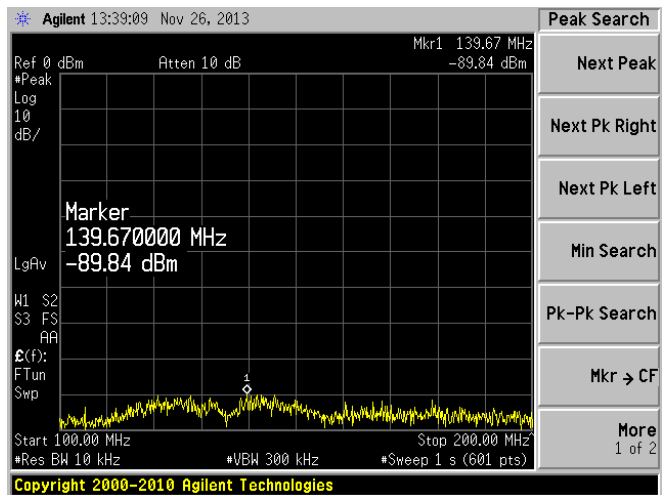
Horizontal Polarized 0.5usec/1200Hz							
Range	Frequency [MHz]	level [dBm]	Pg [dBm]	Cable Loss [dB]	Antenna Gain [dB]	Pd [dBm]	Radiated Spurious Emission [dBc]
10kHz – 100MHz	2.84	-93.36	-72.82	0.18	1	-72	-137.4
100MHz – 200MHz	139.67	-89.84	-70.95	0.32	1	-70.27	-135.7
200MHz – 300MHz	229.33	-92.32	-69.82	0.38	1	-69.2	-134.6
300MHz – 400MHz	395.5	-93.6	-61.59	0.47	5	-57.06	-122.5
400MHz – 500MHz	443.67	-93.29	-48.9	0.50	5	-44.4	-109.8
500MHz – 600MHz	591.17	-93.12	-56.38	0.62	5	-52	-117.4
600MHz – 700MHz	604.5	-92.69	-58.27	0.70	5	-53.97	-119.4
700MHz – 800MHz	716	-92.69	-51.9	0.70	5	-47.6	-113
800MHz – 900MHz	882.83	-92.54	-44.94	0.76	5	-40.7	-106.1
900MHz – 1.0GHz	932.33	-92.52	-53.86	0.81	5	-49.67	-115.1
1.0GHz – 2.9GHz	2723	-70.22	-45.42	1.29	6	-40.71	-106.1
2.9GHz – 6.4GHz	3909	-67.57	-34.59	2.14	6	-30.73	-96.16
6.4GHz – 12.5GHz	9420	-11.48	24.78	3.74	12.5	33.54	-31.89
11.9G – 18GHz	15052	-60.44	-17.76	3.85	13	-8.61	-74.04
17.6G – 26.7GHz	18828	-48.59	-38.32	3.92	20	-22.24	-87.67
26.7G – 40.0GHz	39573	-48.29	-28.65	4.44	20	-13.09	-78.52

Vertical Polarized 0.5usec/1200Hz							
Range	Frequency [MHz]	level [dBm]	Pg [dBm]	Cable Loss [dB]	Antenna Gain [dB]	Pd [dBm]	Radiated Spurious Emission [dBc]
10kHz – 100MHz	98.33	-84.57	-68.95	0.18	1	-68.13	-133.6
100MHz – 200MHz	131	-83.18	-66.69	0.32	1	-66.01	-131.4
200MHz – 300MHz	229.33	-81.43	-48.11	0.38	1	-47.49	-112.9
300MHz – 400MHz	300.83	-92.38	-59.65	0.47	5	-55.12	-120.5
400MHz – 500MHz	493.83	-91.96	-56.04	0.50	5	-51.54	-117
500MHz – 600MHz	584.83	-91.96	-49.55	0.62	5	-45.17	-110.6
600MHz – 700MHz	688.17	-91.18	-50.51	0.70	5	-46.21	-111.6
700MHz – 800MHz	797	-94.29	-55.25	0.70	5	-50.95	-116.4
800MHz – 900MHz	888.17	-93.22	-49.37	0.76	5	-45.13	-110.6
900MHz – 1.0GHz	998.83	-93.57	-46.28	0.81	5	-42.09	-107.5
1.0GHz – 2.9GHz	2412	-70.16	-43.12	1.29	6	-38.41	-103.8
2.9GHz – 6.4GHz	3034	-67.24	-35.23	2.14	6	-31.37	-96.8
6.4GHz – 12.5GHz	9420	-23.26	12.18	3.74	12.5	20.94	-44.49
11.9G – 18GHz	13781	-61.08	-14.96	3.85	13	-5.81	-71.24
17.6G – 26.7GHz	18828	-45.23	-32.87	3.92	20	-16.79	-82.22
26.7G – 40.0GHz	38380	-48.23	-29.71	4.44	20	-14.15	-79.58

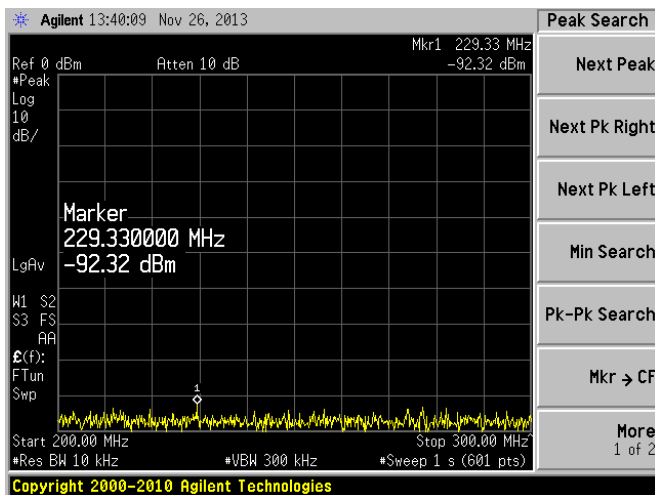
Horizontal Polarized



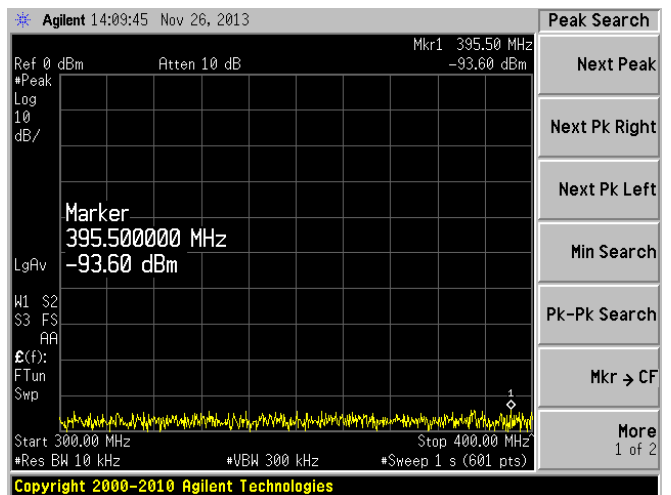
10kHz to 100MHz



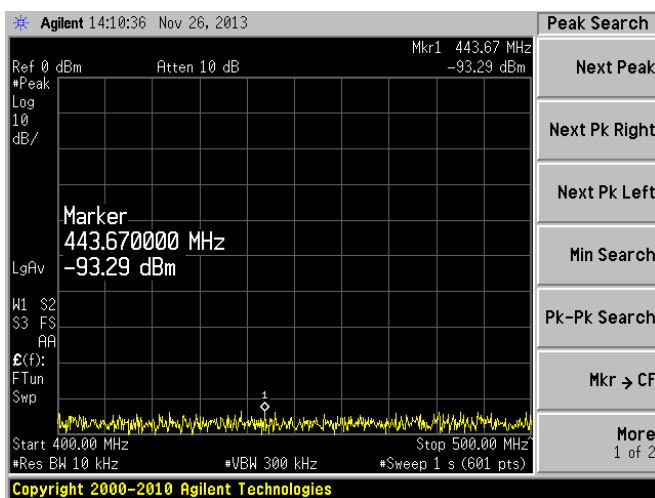
100MHz to 200MHz



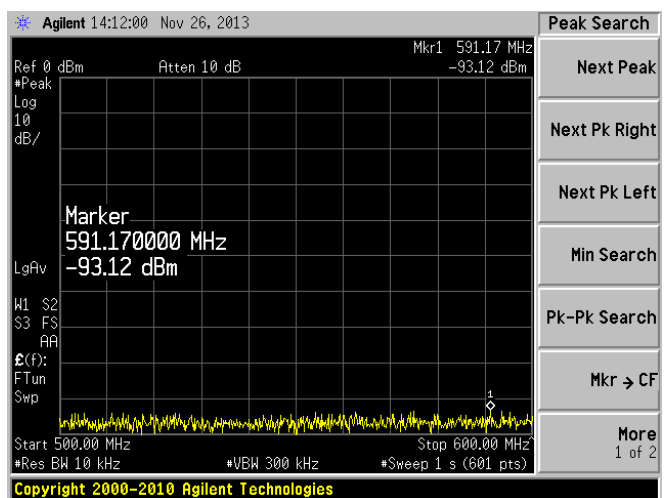
200MHz to 300MHz



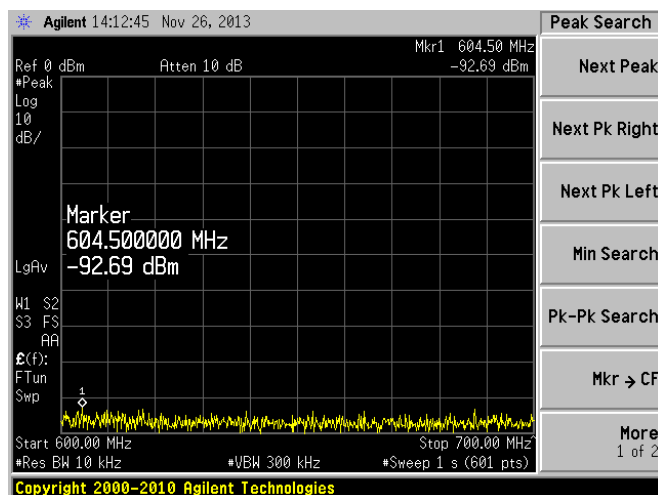
300MHz to 400MHz



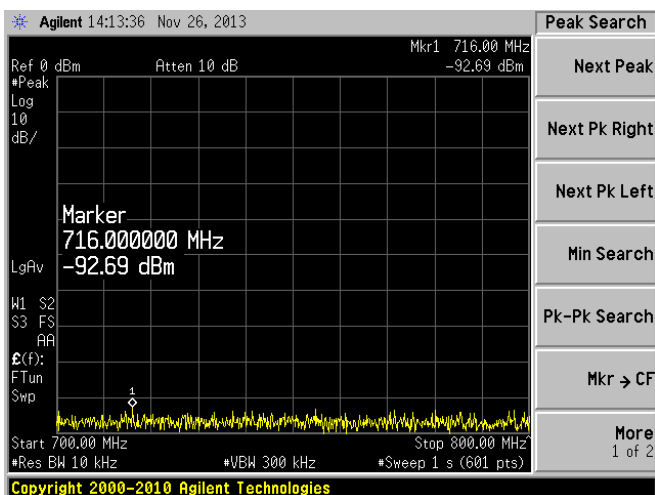
400MHz to 500MHz



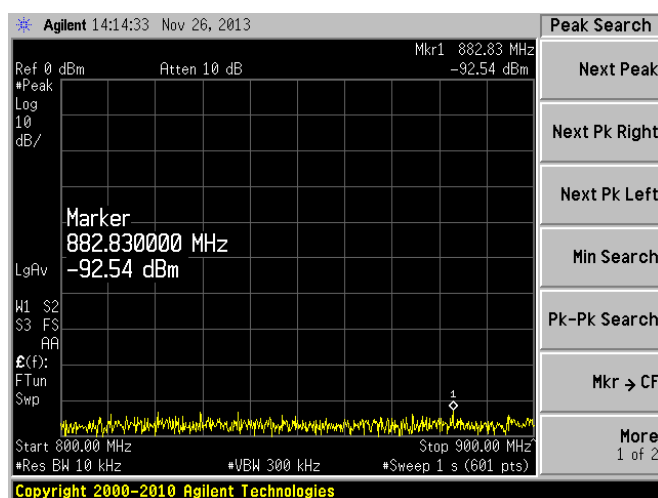
500MHz to 600MHz



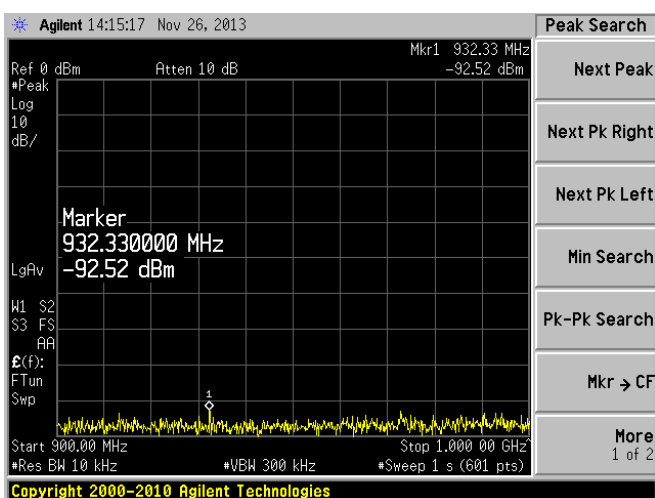
600MHz to 700MHz



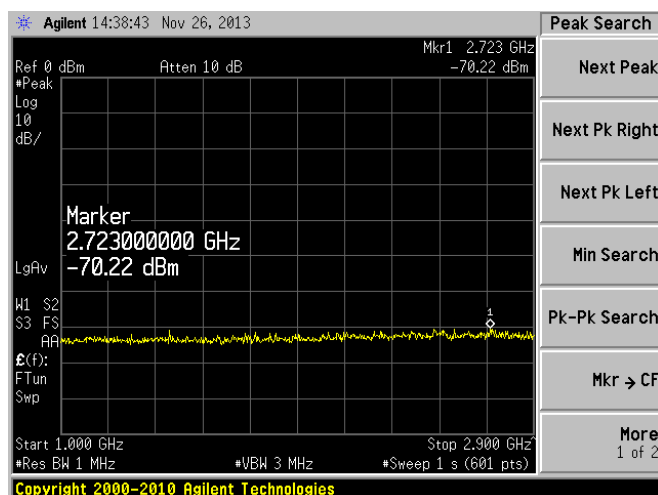
700MHz to 800MHz



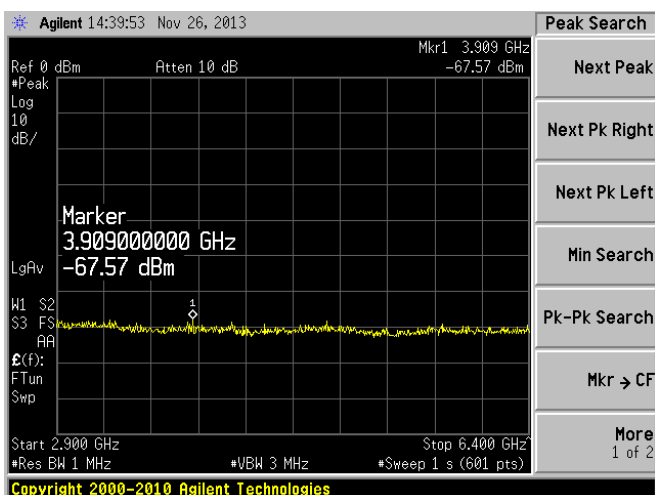
800MHz to 900MHz



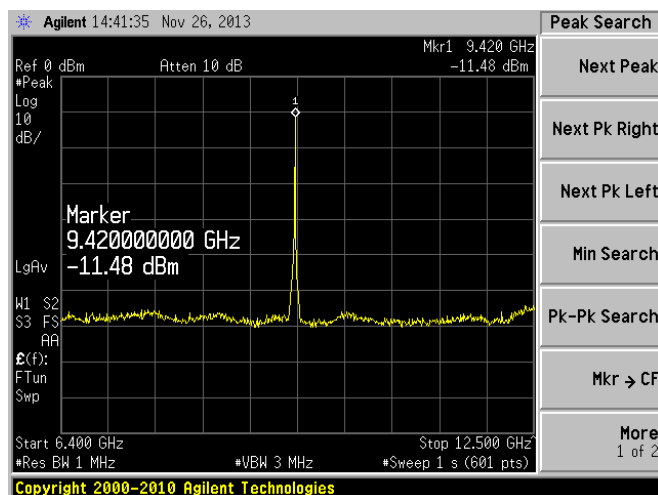
900MHz to 1GHz



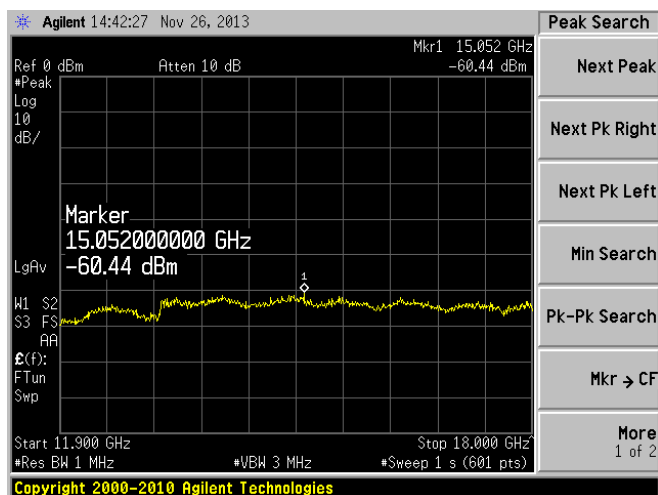
1GHz to 2.9GHz



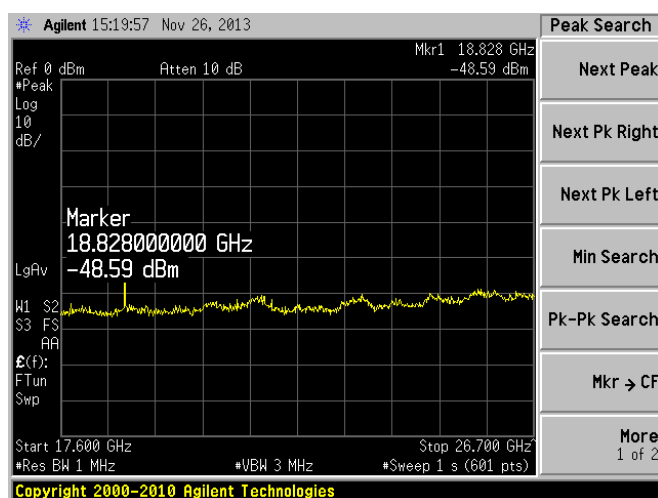
2.9GHz to 6.4GHz



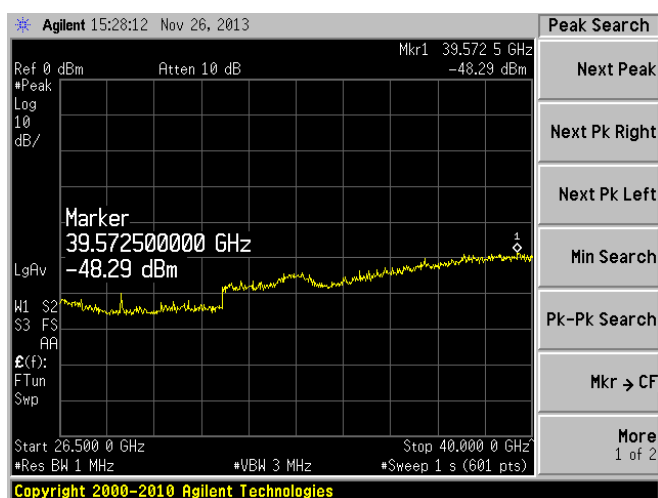
6.4GHz to 12.5GHz



11.9GHz to 18GHz

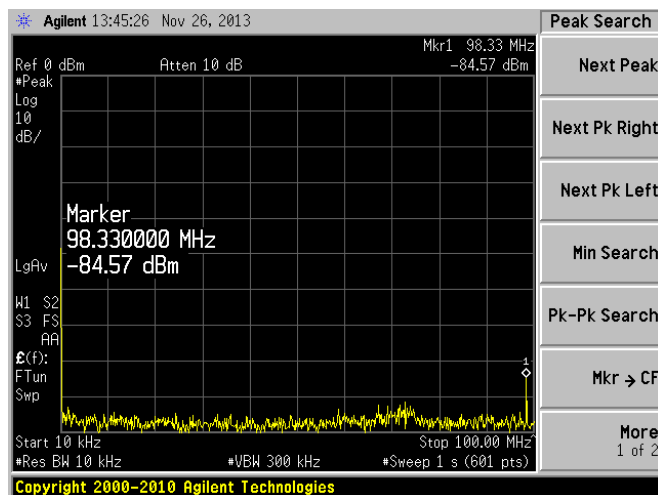


17.6GHz to 26.7GHz

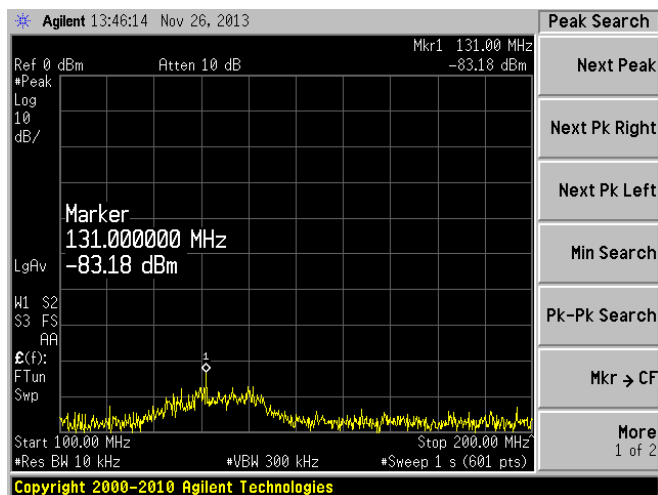


26.5GHz to 40.0GHz

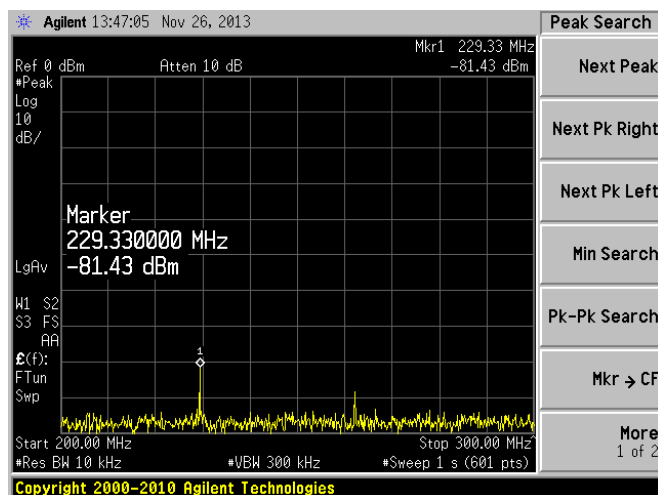
• Vertical Polarized



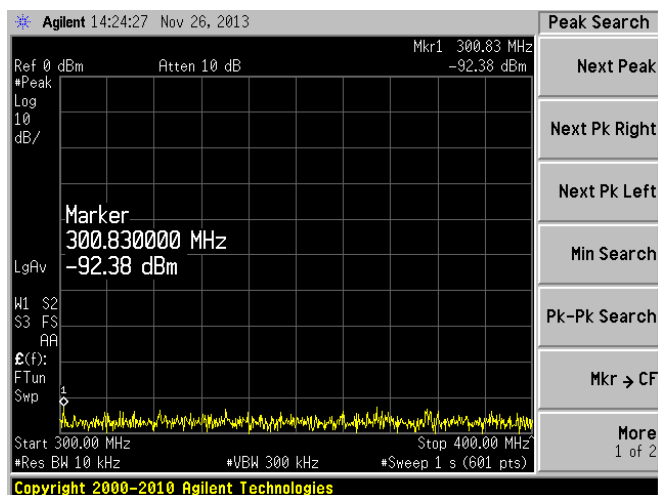
10kHz to 100MHz



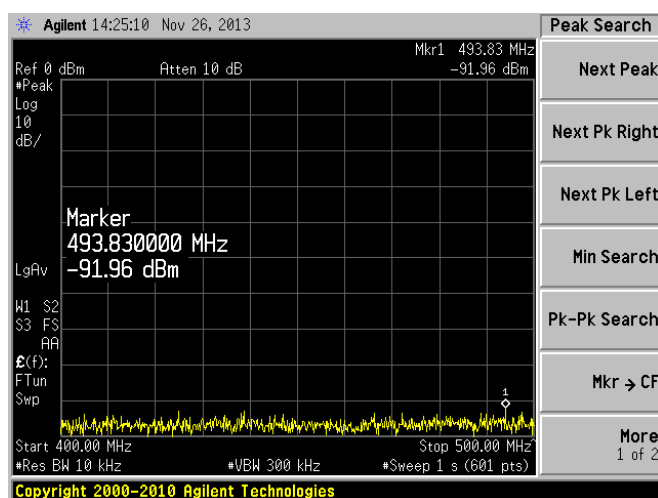
100MHz to 200MHz



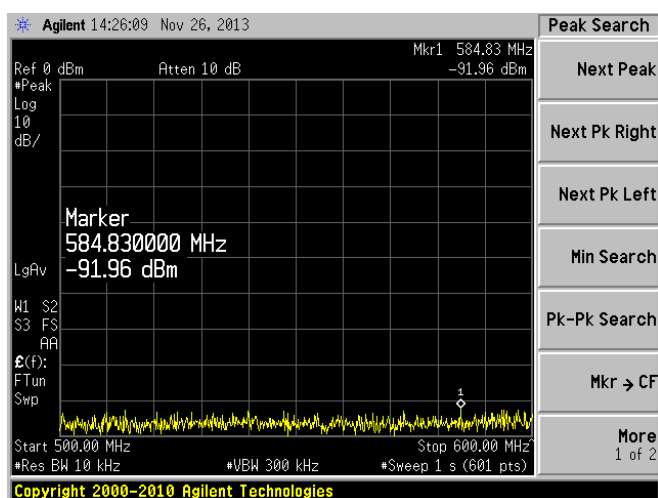
200MHz to 300MHz



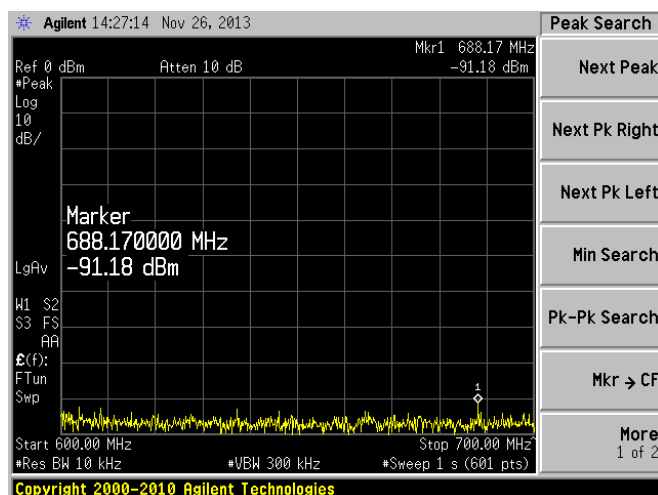
300MHz to 400MHz



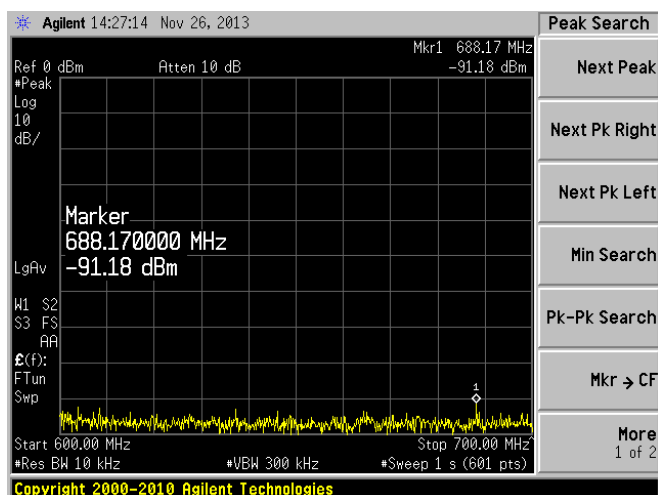
400MHz to 500MHz



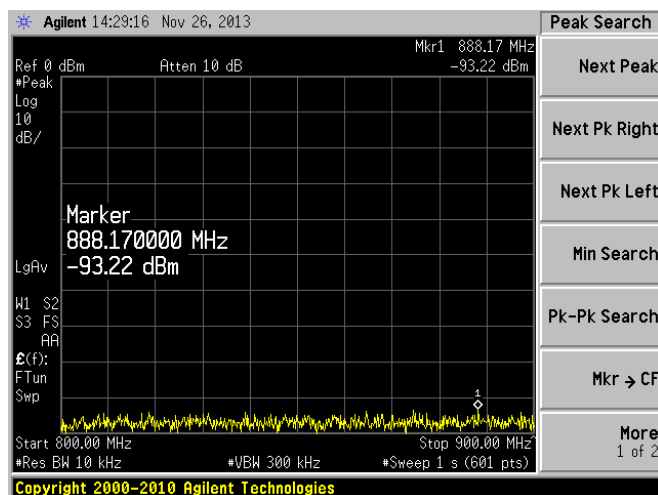
500MHz to 600MHz



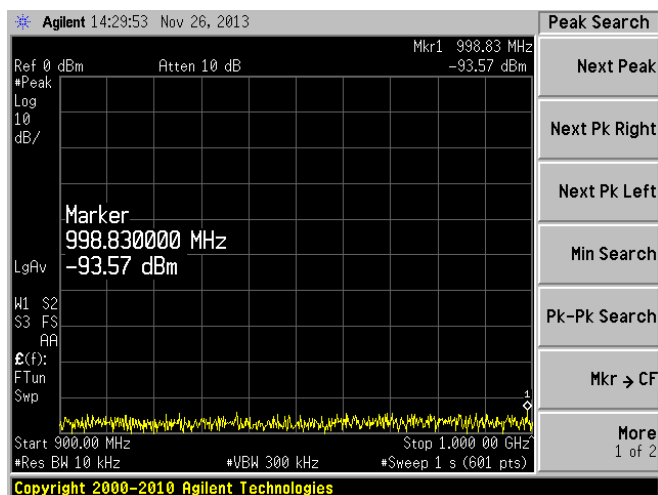
600MHz to 700MHz



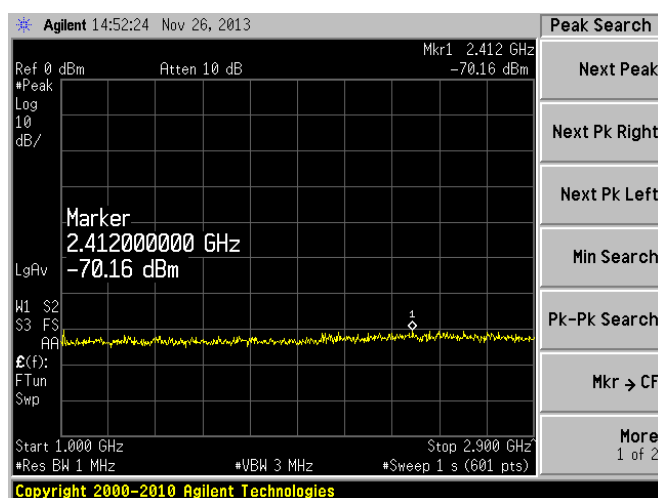
700MHz to 800MHz



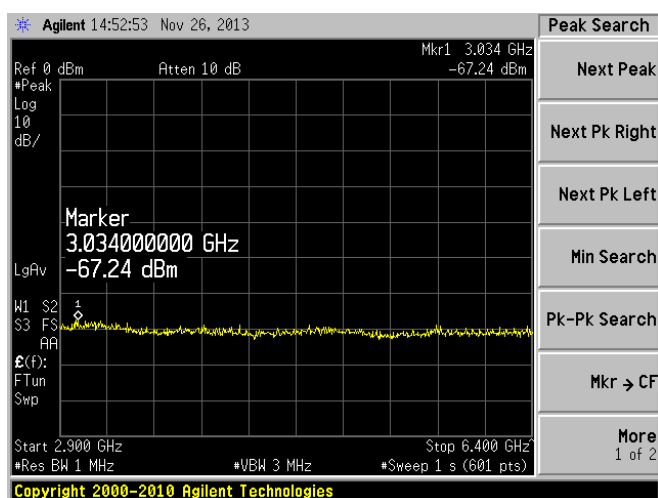
800MHz to 900MHz



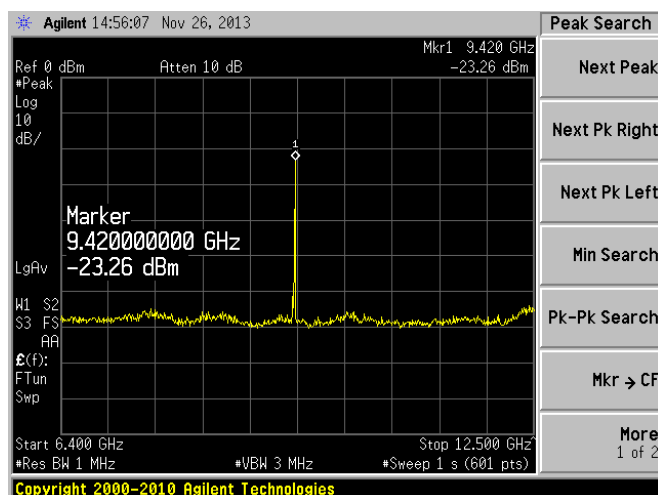
900MHz to 1GHz



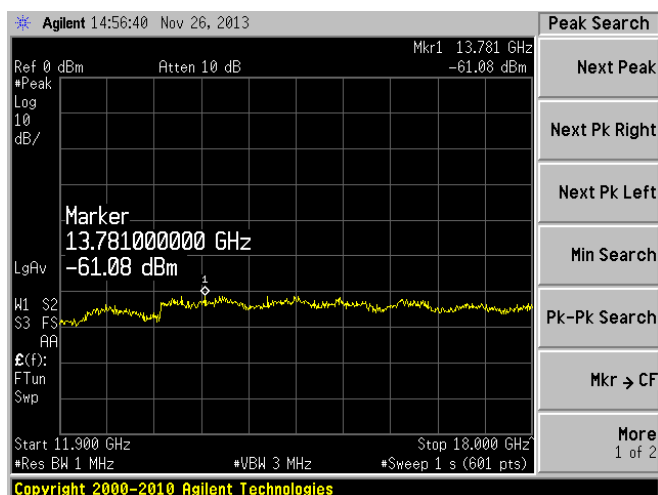
1GHz to 2.9GHz



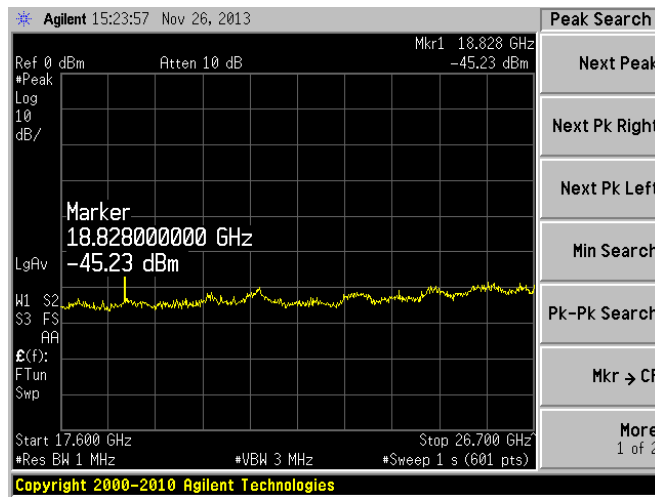
2.9GHz 6.4GHz



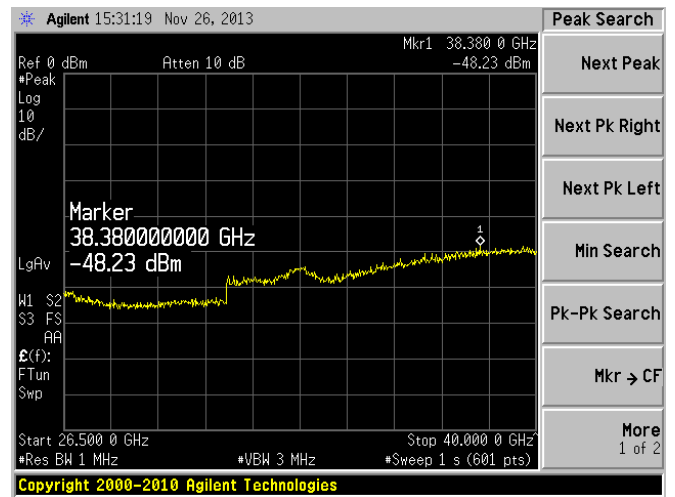
6.4GHz to 12.5GHz



11.9GHz to 18.0GHz



17.6GHz to 26.7GHz



26.7GHz to 40GHz

$$P_d (\text{dBm}) = P_g (\text{dBm}) - \text{Cable Loss} (\text{dB}) + \text{antenna gain} (\text{dB})$$

Where,

P_g is the generator output power into the substitution antenna.

P_d is the dipole equivalent power

and radiated spurious emissions can be calculated by the following:

$$\text{Radiated spurious emissions} (\text{dBc}) = - \left[10 \log \left(\frac{TX \text{ power in watts}}{0.001} \right) - P_d (\text{dBm}) \right]$$

4.6 Radiofrequency radiation exposure limits.

47 CFR sec. 1.1310

Power density = 0.127 [mW/cm²] is satisfied about 5 [mW/cm²].

Frequency range [MHz]	Electric field strength [V/m]	Magnetic field strength [A/m]	Power density [mW/cm ²]	Averaging time [minutes]
1500 – 100,000	58.6	0.142	0.127	6

Calculated by prediction method refer to OET Bulletin 65 as follows;

$$\begin{aligned}\text{Power density } S_{\text{limit}} &= \frac{PG}{4\pi R^2} \\ &= \frac{2210 * 355}{4 * \pi * 702^2} \\ &= 0.127 \text{ [mW / cm}^2\text{]}\end{aligned}$$

Where, P = 2210mW (power input to antenna)
G = 10^{^(dB/10)} = 10^{^(25.5/10)} = 355 (power gain of the antenna)
R = 702cm (distance to the center of radiation of antenna)

Distance to the center of radiation of antenna

$$\begin{aligned}R &= \frac{0.6D^2}{\lambda} \\ &= \frac{0.6 * 61.0^2}{3.18} \\ &= 702\end{aligned}$$

where: D = 61.0cm (antenna diameter)
 λ = 3.18cm (wavelength) f = 9410MHz

Power density level(s) during the appropriate time-averaging interval

$$\begin{aligned}\sum S_{\text{exp}} t_{\text{exp}} &= S_{\text{limit}} t_{\text{ave}} \\ &= 0.127 * 6 \\ &= 0.762\end{aligned}$$

Electric field strength

$$\begin{aligned}E &= \sqrt{S * 3770} \\ &= \sqrt{0.474 * 3770} \\ &= 53.6 \text{ [V/m]}\end{aligned}$$

Magnetic field strength

$$\begin{aligned}H &= \sqrt{\frac{S}{37.7}} \\ &= \sqrt{\frac{0.474}{37.7}} \\ &= 0.142 \text{ [A/m]}\end{aligned}$$